

Annual Report 2013-14



Bangladesh Agricultural Research Council

National Agricultural Research System (NARS)

Institute	Ministry	Areas of Research
Bangladesh Agricultural Research Council (BARC), Dhaka	Agriculture	Strengthen the national agricultural research capability through research planning, coordination, integration and resource allocation
Bangladesh Agricultural Research Institute (BARI), Joydebpur, Gazipur	Agriculture	Basic, applied and adaptive research on cereals (other than rice), pulses, oilseeds, vegetables, horticultural crops etc.
Bangladesh Rice Research Institute (BRRI), Joydebpur, Gazipur	Agriculture	Basic, applied and adaptive research on rice
Bangladesh Jute Research Institute (BJRI), Sher-e-Bangla Nagar, Dhaka	Agriculture	Basic, applied and adaptive research on jute production and utilization
Bangladesh Institute of Nuclear Agriculture (BINA), Mymensingh	Agriculture	Application on nuclear technology in agriculture
Bangladesh Sugarcane Research Institute (BSRI), Ishurdi, Pabna	Agriculture	Applied and adaptive research on sugarcane
Soil Resource Development Institute (SRDI), Farmgate, Dhaka	Agriculture	Soil survey, soil classification and soil characterization
Cotton Development Board (CDB), Khamarbari, Farmgate, Dhaka	Agriculture	Cotton production and research
Bangladesh Fisheries Research Institute (BFRI), Mymensingh	Fisheries and Livestock	Marine and freshwater fisheries research
Bangladesh Livestock Research Institute (BLRI), Savar, Dhaka	Fisheries and Livestock	Basic and applied research on cattle, buffalo, sheep, goats, poultry, duck, etc.
Bangladesh Forest Research Institute (BFRI), Sholashahar, Chittagong	Environment and Forests	Forestry and agroforestry research
Bangladesh Tea Research Institute (BTRI), Srimangal, Moulvibazar	Commerce	Applied and adaptive research on tea
Bangladesh Sericulture Research and Training Institute (BSRTI), Baliapukur, Rajshahi	Textile and Jute	Research and training on sericulture

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Executive Summary

The Annual Report of this year presents the activities of Bangladesh Agricultural Research Council associated with governance, management and development of research programmes in the National Agricultural Research System. Highlights of the progress of the activities during 2013-2014 have been focused in this report.

Executive Council Meeting

The 8th, 9th, 10th, and 11th meetings of Executive Council of BARC were held on 22 August, 4 December of 2013 and 23 February and 5 April of 2014 respectively in the BARC conference room. The 8th meeting, among other matters, approved 55 SPGR sub-projects along with their revised budget, Bangladesh Jute Research Institute presented their master plan. The Chairman of EC also requested other NARS institutes to send their master plan to BARC. The meeting also discussed the daily rent of the banglow, rest/guest house and dormitory of the NARS institutes. The 9th meeting considered, among others, the approval of the recommendation of promotion/recruitment committee-2 of BARC, time extension of 32 SPGR sub-projects on no-cost basis, approval of the research programme and budget for 2013-2014 of SRDI, and presentation of master plan of BSRI and BRRI. The 10th meeting considered, among others, the approval of the recommendation of promotion/recruitment committee-1 of BARC, criteria for determining retirement age 62 or 67 for agricultural scientists of NARS institutes, approval of the research programme and budget for 2013-2014 of BARI and BJRI, presentation of master plan of BINA and BARI. The meeting also discussed the enhancement of daily rent of BARC auditorium. The 11th meeting approved the recommendation of promotion/recruitment committee-2 of BARC, discussed the matter relating to the project proposals under PIU-BARC: phase-I Additional fund of USAID. The meeting also discussed and approved the research proposals and budget of BSRI for 2013-14. The meetings also approved the appointment and promotion of BARC and others NARS institutes' officers.

PROJECT IMPLEMENTATION

Characterization of Important Plant Genetic Resources: The project *Characterization of important plant genetic resources* was initiated during January 2012 to June 2014 with the financial support of PIU-BARC, NATP: Phase-I. The project was a coordinated project of Bangladesh Agricultural Research Council with 6 NARS institutes viz. Bangladesh Agricultural Research Institute, Bangladesh Rice Research Institute, Bangladesh Jute Research Institute, Bangladesh Sugarcane Research Institute, Bangladesh Institute of Nuclear Agriculture, Cotton Development Board and Bangladesh Agricultural University. A total of 893 genotypes of 31 different mandate crops of NARS institutes have been characterized. Morphological characterization has been done on 54 varieties of those crop, and molecular characterization was done on 42 mungbean genotypes.

AFACI Project

Development of variety, cropping system research and technology transfer of major cereals for sustainable food security in Bangladesh

The AFACI is an initiative of RDA, Republic of Korea to support Asian countries to stimulate the sustainable agricultural growth through the international R&D cooperation in agriculture and food sector. In this context, the project was initiated in June, 2010 involving BARI, BRRI, DAE and BADC for executing the project activities. The specific objectives was to develop and evaluate advanced materials for higher yield, tolerant to salinity, submergence and temperature for rice and wheat (where applicable) and to develop participatory research and technology transfer programme for sustainable crop production and to update the knowledge and skills of agricultural professionals through training/visit/study tour/exchange programme. The project has been successfully completed on December 2013. The project got one of the best project honor among 10 member

countries. The crest was handed over to EC, BARC on August, 2013 during ANSOFT expert workshop in Dhaka.

Development of Locally Appropriate GAP Programs and Agricultural Produce Safety Information System of Selected Crops in Bangladesh

Presently, a good number of vegetables and fruits are being exported to the ethnic communities in Europe and Middle East from Bangladesh. But Bangladeshi fruits and vegetable produces cannot access to the upstream markets due to absence of globally accepted good agricultural practices (GAP). Fresh vegetables and fruits will be potential export sector and create employment opportunity and improve the livelihood of rural people, if GAP is strictly followed.

Under the technical assistance of AFACI-GAP supported program, GAP protocol for Mango and tomato have been developed to minimize the risk of hazards occurring during the production, harvesting and post harvest handling that will cover food safety, quality, environmental impacts and health, safety and welfare for workers.

Collection, characterization and utilization of rice, minor cereals and chilli in Bangladesh

A Pan Asian project *Integrated Management System of Plant Genetic Resources (IMPGR)* has been implemented in the eleven member countries since January 2012. As a member, Bangladesh is also implementing a project entitled *Collection, characterization and utilization of rice, minor cereals and chilli in Bangladesh* under IMPGR project. BARC is acting as coordinating agency while BARI and BRRI as implementing organization. A good number of germplasm were collected from Barisal region, Bhola, Gopalganj with the participation of BARC scientists. The collected germplasm beyond the project target included vegetables and other crops. Co-Principal Investigator from BRRI part have attended the expert workshop held in Nepal in

2013. Two scientists from BARI and BRRI have been trained on Plant Genetic Resources Management in Korea during April 2014.

Establishment of network and model manual on postharvest technology of horticultural crops in Asia

Under this project the postharvest manual of Cabbage (*Brassica oleracea* var. capitata L.) has drafted during 2013-14 period. The project has been designed to develop the postharvest manuals of tomato, cabbage and mango in three years period. First year the postharvest manual of tomato has been developed. In 2nd year the postharvest manual of cabbage has drafted.

Farming Systems Research and Development Sub-project

The SPGR Sub-project was coordinated by Crops Division, BARC and implemented by NARS Institutions viz. BARI, BRRI, BJRI, BSRI, BINA, BLRI, BFRI (Fish) and BFRI (Forest). The goal of the project was to develop farming systems technologies to maximize productivity and efficient utilization of resources. The project was commenced with a holistic approach that includes the integration of different components of farming systems like crops, livestock, fisheries, agro-forestry and homestead agro-forestry.

A National Task Force Committee was formed to oversee the FSRD project activities. Coordination meeting and progress review workshop were organized as per project proposal and the proceedings of each workshop were distributed among the participants for necessary action. Several visits were made by the project coordinator, associate coordinator, PI and the technical staff and comments/suggestions were made based on field observations and are incorporated in the trip reports and sent to the respective PIs.

Project Management	Implementation/	Project
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A total of 108 Sponsored Public Goods Research (SPGR) sub-projects in selected identified thematic areas were being implemented at different NARS institutes and public universities of the country by Project Implementation Unit of Bangladesh Agricultural Research Council. Planning and Evaluation Division, with the assistance of the other divisions, is also monitoring the SPGR sub-projects.

A Technical Assistance Project Proposal (TPP) entitled *Adaptation to Climate Change and Rehabilitation of Livelihood in South West of Bangladesh (CLAP)* has been developed for funding from German Development Corporation (GIZ). The German Government has morally accepted the project concept and the TPP of the project is now under approving.

A seven member Proposal Evaluation Committee (PEC) under the provision of Public Procurement Regulations 2008 was formed comprising of Member-Director (Administration and Finance) as Chairperson. Among others Dr. Paresh Chandra Golder, Member-Director (Planning & Evaluation), BARC as a member made major contribution in recruiting the National Core and Short-term Consultants for the National Agricultural Technology Project (NATP)-Phase-I and also in the Agricultural Research Management Information System (ARMIS) project.

Research Management and Coordination

To facilitate research and technology transfer, the Bangladesh Agricultural Research Council provides research grants to various public organizations since 2004. During the fiscal year 2013-14, coordinated 38 research programmes of the NARS, and agricultural universities through funding of the core research and human resource development. Further, frequent review and desk/field monitoring have been done for its success. An

amount of Tk. 140.00 lakhs was provided to these research programmes.

Monitoring of the Research Programme

To review the monitoring and evaluation activities of the NARS institutes a workshop was organized with the view to formulate suggestions in strengthening the M&E activities at the NARS and particularly SPGR sub-projects of NATP. Participants comprising of the M&E Cell members of BARC and the NARS institutes, scientists of BARC, consultants of the Project Coordination Unit (PCU) and the Project Implementation Unit (PIU) of BARC attended the workshop.

Establishment of MIS-ICT facilities at NARS

The MIS-ICT has already been installed in 7 NARS institutes and BARC. The main responsibility under this activity was to provide required support for the development and deployment of MIS (9 modules) at BARC and NARS institutes.

Foundation Training

The four-month long 24th Foundation Training Course for the NARS scientists was organized at Bangladesh Academy for Rural Development (BARD) in Comilla. This four-month long course contents include major five areas including Bangladesh Studies, Public Administration, Development Economics, Skill Development and other modules in promising areas.

Administrative and Financial Management

BARC organized a 14-day training program on Administrative and Financial Management at Bangladesh Academy for Rural Development, Kotbari, Comilla to provide senior/mid level scientists/researchers with the modern concepts of administrative and financial management system.

Training on Research Methodology

To equip the scientists with necessary knowledge and skill in writing research proposal and manage the project, planning, execution, monitoring and evaluation of research activities 2 training programs have been organized under revenue funding.

In-country and foreign PhD programme under revenue, NATP Phase 1 and other scholarship have been offered to the NARS scientists. Besides NATP/Revenue funded training/workshop/higher study/study visit programs at

home and abroad have been organized on agricultural research and policy related matters.

National and International Linkages

MoU/Bilateral agreement, Collaborative Work plan signed during the year with different countries and international organizations in the areas of human resource development, technical cooperation, knowledge sharing and exchange of germplasms.

I. HIGHLIGHTS OF RESEARCH AND DEVELOPMENT

CROPS

PROJECT IMPLEMENTATION

Characterization of Important Plant Genetic Resources: A research project was conducted on *Characterization of important plant genetic resources* during January 2012 to June 2014 with the financial support of PIU-BARC, NATP: Phase-I. The project was a coordinated project of Crops Division of Bangladesh Agricultural Research Council with 6 NARS institutes viz. Bangladesh Agricultural Research Institute, Bangladesh Rice Research Institute, Bangladesh Jute Research Institute, Bangladesh Sugarcane Research Institute, Bangladesh Institute of Nuclear Agriculture, Cotton Development Board and Bangladesh Agricultural University. As the coordinating agency BARC organised inception workshop, review workshop, field visit, monitored and supervised the total research activities during the entire project period. This research work has been undertaken to study the morphological and molecular characterization of Geographical Indication (GI) crops, varieties and germplasm of important crops and fruits. A total of 893 genotypes of 31 different mandate crops of NARS institutes have been characterized. Monocrop research institute like BRRI, BJRI, BSRI and CDB characterized rice, jute, sugarcane and cotton respectively. Multicrop research organization like BARI, BINA and BAU characterized 11, 12 and 5 different crops respectively. Among 11 mandate crops viz. Mango, Betel leaf, Mungbean, Litchi, Banana, Citrus (Lime, Lemon and Citron), Wild orange, Burmese Grape, Golden apple and Bel of BARI, morphological characterization has been done on 54 varieties of those crop, and molecular characterization done on 42 mungbean genotypes (1 GI, 6 released varieties and 35 advanced lines). BINA has done morphological characterization of 57 varieties of 12 crops viz. Rice, Mustard, Sesame, Soybean, Groundnut, Mungbean, Chickpea, Lentil, Blackgram, Garsspea, Tomato and Jute; 173 germplasm and 3 GI crops (*Kalikolai* of blackgram, *Sonamoog* of mungbean and 'Local til' of sesame). Molecular characterization has also done of 31 varieties, 102 germplasm and 3 GI crops by using SSR and RAPD markers. BRRI characterized 264 rice germplasm and 20 GI rice. Bangladesh Jute Research Institute characterized 48 germplasm of deshi jute and 47 germplasm of tossa jute as per descriptor of IJO and molecular characterization was done in 9 germplasm. BSRI characterized 100

sugarcane germplasm including 2 GI sugarcane and molecular markers based DNA fingerprinting was done in 34 varieties. CDB characterized 200 germplasm of cotton. BAU have completed 51 morphological characterizations of which 20 GI crops (Guava, Jujube and Aroids), 17 mango varieties and 14 banana germplasm. Besides, 8 molecular characterizations have also done on 2 GI fruits of Guava and Jujube.

AFACI Project

Development of Variety, Cropping System and Technology Transfer of Major Cereals for Sustainable Food Security in Bangladesh

The project has successfully completed on December 2013. The project got one of the best project honour among 10 member countries. The crest was handed over to EC, BARC on August, 2013 during ANSOFT expert workshop in Dhaka. Rice, the staple food crop and wheat is the 2nd important cereal of Bangladesh. The crop variety and component technologies have been developed so far addressing the plain land agriculture and normal ecosystem. But the situation is changing due to climate changes. For these, participatory research, demonstrations, field trials, farmer's trainings, field days etc. could be initiated for successful adoption of the appropriate/modern technologies.

The AFACI is an initiative of RDA, Republic of Korea to support Asian countries to stimulate the sustainable agricultural growth through the international R&D cooperation in agriculture and food sector. In this context, a project entitled "Development of variety, cropping system research and technology transfer of major cereals for sustainable food security in Bangladesh" was initiated in June, 2010. In these aspects, BARI, BRRI, DAE and BADC involved for executing the project activities. The specific objectives was to develop and evaluate advanced materials for higher yield, tolerant to salinity, submergence and temperature for rice and wheat (where applicable) and to develop participatory research and technology transfer programme for sustainable crop production and to update the knowledge and skills of agricultural professionals through training/visit/study tour/exchange programme. The overall goal of the project is to increase agricultural production through variety development, cropping system, technology transfer for sustainable food security.

Plant Breeding, Rice Farming and Applied Research Division of BRRI are implementing the research programmes and some genotypes of rice including BRRI dhan47 showed better performance in saline area. The submergence tolerant variety (BRRI dhan52) gave high yield in 14 days flooding with flooding depth 30-75 cm. Double transplanting allowed to fit short duration mustard variety (BARI Sharisha14) in T.aman- Mustard-Boro patten. Besides, alternate wet and drying (AWD) with USG showed better performance than prilled urea.

Wheat research centre, BARI carried out research thrust on wheat where genotype BAW1141 showed higher yield under high temperature conditions. BARIGom 23, 24 and 25 with improved management packages in coastal areas with grain yield of 2.63 t/ha to 3.06 t/ha. The variety BARIGom26 gave higher grain yield (4.01 t/ha) followed by BARIGom 25 in Rajbari and Faridpur. DAE demonstrated wheat variety Prodig, BARIGom 25/26 in non-traditional wheat area, Bagerhat which gave grain yield of 3.5-4.0 t/ha. Besides, rice variety (BRRI dhan47, BRRI dhan55 and Binadhan 8 yielded 5-7 ton/ha in Fakirhat and Mollahat, Bagerhat. BADC produced 2 tons of quality seeds of Boro rice var BRRI dhan29 at Modhupur and 4 tons of wheat variety BARIGom25 and 26 at Bhangha and Rangpur. Besides, respective organizations conducted farmers training and field days to grow new varieties with management packages.

Development of Locally Appropriate GAP Programs and Agricultural Produce Safety Information System of Selected Crops in Bangladesh

Good Agricultural Practices (GAP) have been developed aiming to codify agricultural practices at farm level for a range of agro-commodities. Demand of safe and high quality food produced under GAP have been increasing in recent years. Many developing countries including Bangladesh are facing challenges in national and international trading under WTO, free trade agreements, multiplicity of governmental GAP standards and private sector requirements. Therefore, implementation of GAP is essential to contribute in agricultural development.

Under the technical assistance of AFACI-GAP supported program, GAP protocol for Mango and tomato have been developed to minimize the risk of hazards occurring during the production, harvesting and post harvest handling that will cover food safety,

quality, environmental impacts and health, safety and welfare for workers.

Presently, export of Bangladeshi agricultural products is increasing significantly. A good number of vegetables and fruits are being exported to the ethnic communities in Europe and Middle East from Bangladesh. But Bangladeshi fruits and vegetable produces cannot access to the upstream markets due to absence of globally accepted good agricultural practices (GAP). Fresh vegetables and fruits will be potential export sector and create employment opportunity and improve the livelihood of rural people, if good agricultural practices (GAP) are strictly followed.

Work so far done in Year II (Sept 2013 – Aug 2014)

- Conducted survey for mango and compiled three sets of survey data on mango and tomato.
- Conducted programme planning meetings to review the progress of the target activities. Edited the draft manuals on the target crops (Mango & Tomato).
- Conducted training on GAP concept to scientists, professionals, field level agricultural extension workers and farmers.
- Development of draft GAP manual on focus crops (mango and tomato).
- GAP network with the relevant scientists, officers were developed (initially 35 members were listed with a registration form).
- Attended annual Progress Review Workshop (PI meeting) at Bali, Indonesia.

Major outcome

- Knowledge and awareness on GAP for fruits and vegetables as well as food safety assurance have been developed;
- GAP manuals of mango and tomato have developed (in press) in both English and Bengali first time in Bangladesh and using as base materials for trainings and others activities by different stakeholders;
- GAP network in Bangladesh have developed first time with 35 professionals in and create huge interest on GAP;
- GAP professionals have developed through training on ‘GAP concept & principles for fruits & vegetables production’ and farmers and field level extension were trained in the target areas on the focus crops;

- Training lecture on GAP concept and principles have been developed both English and Bengali which is using in different training programme for farmers and professionals;
- Technical knowledge and skills developed from this project on GAP is being sharing with other stakeholders for developing GAP activities and projects.

Conclusion

- This project is the very good start for GAP in Fruits and vegetables in Bangladesh. GAP manuals will be used in field level to ascertain safe production and support export of fresh fruits and vegetables.
- More manuals on other products/crops will be developed with knowledge and skill developed from this project.
- Large scale training need to be provided to farmers, extension workers, producers, traders and exporters to adopt GAP protocol in practice.
- GAP certification agency need to be developed in Bangladesh.

Collection, characterization and utilization of rice, minor cereals and chilli in Bangladesh

A Pan Asian project “Integrated Management System of Plant Genetic Resources (IMPGR) under the financial assistance of Asian Food & Agriculture Cooperation Initiative (AFACI) has been implementing in its eleven member countries since January 2012. As a member of AFACI, Bangladesh is also implementing a project entitled “Collection, characterization and utilization of rice, minor cereals and chilli in Bangladesh” under IMPGR project. The Specific objectives of this project are: i) to secure the germplasm of rice, minor cereals and chilli through exploration, collection and regeneration in Bangladesh; ii) to develop management system for PGR for easy access by the users; iii) To secure the sustainable use and conservation of safety back-up of genetic resource in Bangladesh. BARC is acting as coordinating agency while BARI and BRRI as implementing organization. A good number of germplasm were collected from Barisal, region, Bhola, Gopalganj with the participation of BARC scientists. The collected germplasm beyond the project target included vegetables and other crops. Co-Principal Investigator from BRRI part have attended the expert workshop held in Nepal in 2013. Two scientists from BARI and BRRI have been trained

on Plant Genetic Resources Management in Korea during April 2014.

The Plant Genetic Resources Centre (PGRC), BARI have been collected 129 chilli, 18 foxtail millet, 1 barley, 1 buckwheat and Genetic Resources and Seed Division (GRS) while BRRI collected 79 rice germplasm. Morphological characterization has been done of the collected germplasm. Besides these 129 chilli, and 51 rice germplasm have been regenerated. A total of 466 germplasm of 52 crops other than the assigned crops have been collected during exploration of the selected project areas. About 299 germplasm of four minor cereals (foxtail-135, prosomillet-50, barley-54 and sorghum-60) have been characterized morphologically from base collection up-to June 2014.

Establishment of network and model manual on postharvest technology of horticultural crops in Bangladesh (September 2012 to August 2015)

The project is going on properly. Both Tomato and Cabbage manual draft have been developed. Cabbage manual draft was reported in the last expert workshop of AFACI held in Cambodia on March 2014.

Some Suggested Interventions in Post-harvest management in Bangladesh

- Conduct national survey on post harvest loss of highly perishable horticultural crops.
- Establish packing house and cool storage at grower’s level and wholesale markets of the horticultural crops.
- Encourage private sector to establish multipurpose cold storage, packing house, ripening house, cool chain transportation system, marketing infrastructure etc.
- Improve the packages in respect of container, size, dimension and durability at a reasonable rate.
- Explore the possibility of mini scale storage using the solar energy.
- Strengthen the existing water and railway transportation system for fresh horticultural crops
- Promote to set up small scale high value crop based processing industry and assist them to get certification from recognized authority.
- Strengthen research on post harvest technology in respect of capacity building and logistics support to provide demand-driven technology.

- Impart training to different stakeholders on various aspects of post harvest management and demonstrate post harvest technology to create awareness among them.
- Strengthen the extension activities on post harvest technology.
- Improve farmer market linkage through IT system providing market intelligence support.
- Establish networking and data bank on post harvest technology.
- Strengthening export facilities of fresh and frozen horticultural crops as per growing demand.
- Development of appropriate technology for harvesting, handling, packaging, storage, transportation and processing
- Shortening of marketing channel and value chain development.
- Development of cool chain facility, packaging and value chain management including waste disposal in the production areas.
- Knowledge and awareness building on post harvest management and value addition of growers and traders.
- Strengthening technology transfer activities on postharvest management of cabbage.

Conclusion

- Post harvest loss of horticultural crops is a national problem.
- High spoilage of harvested crops especially fruits and vegetables must be minimized to an acceptable limit to improve the availability and our health, nutrition, and economy.

Establishment of network and model manual on postharvest technology of horticultural crops in Asia

Under this project the postharvest manual of Cabbage (*Brassica oleracea* var. capitata L.) has drafted during 2013-14 period. Actually this project has designed to developed the postharvest manuals of tomato, cabbage and mango in three years period. First year the postharvest manual of tomato has developed. In 2nd year the postharvest manual of cabbage has drafted. The draft report will be finalized for locally print in both Bengali and English. In Bangladesh, Cabbage (*Brassica oleracea* var. capitata L.) is a highly nutritious and popular leafy vegetable. It is an introduced vegetable crop, but it has adapted itself well and is grown all over the country mainly in winter. Recently some heat tolerant varieties of cabbage are grown in summer. Red cabbage is also grown in limited scale. Cabbage is a rich source of vitamins like A, B, C, E and K. It also contains appreciable amounts of dietary fiber, manganese, folate, calcium, magnesium and potassium.

Challenges of Post-harvest management of cabbage in Bangladesh

- Development of heat tolerant cabbage variety.
- Selection of high yielding variety with better shelf life.

The draft postharvest manual is as follows:

1. Area and production

In Bangladesh, cabbage is an introduced vegetable crop, but it has adapted and grown well all over the country in winter. Presently, an appreciable amount of cabbage is produced each year in Bangladesh. During 2010-11, 2.20 lakh metric tons of cabbage were produced from 16673 ha of land (BBS 2011). Cabbage is grown all over the country but the predominant cabbage growing areas are Jessore, Kushtia, Tangail, Jamalpur, Rangpur, Rajshahi, Dhaka and Dinajpur.

2. Varieties

The varieties presently cultivated in Bangladesh are mostly hybrids which are imported from Japan, China and Europe. However, some local seed companies are also marketing seeds of hybrid varieties of cabbage. Red cabbage is also becoming popular in Bangladesh. Apart from hybrid varieties BARI (Bangladesh Agricultural Research Institute) has developed two open pollinated varieties, namely Provati (BARI Badha Kopi-1) and Agradut (BARI Badha Kopi-2).

3. Cultivation procedure

- Cabbage is winter loving crop and grown well at winter season.
- Seeds to be sown in seed bed in August, September or November for early, mid and late season cultivation, respectively.
- Seedlings of 35 days old are suitable for transplanting in prepared land with spacing 60 × 45 cm.
- Cabbage heads become harvestable within 90-120 days after seeding.
- The average yield is 75-100 tons ha⁻¹.

4. Postharvest loss

4.1 Magnitude of postharvest loss

- Cabbage is highly perishable vegetable crop
- The estimated postharvest loss of cabbage in supply chain is around 25% in Bangladesh.

4.2 Principal causes of postharvest loss

- Inadequate infrastructures for postharvest handling.
- Increased respiration, ethylene production and transpiration.
- Sub-standard postharvest handling.
- Microbial decay.

5. Harvesting

- Determining right stage of maturity is of paramount importance to ensure optimal quality and longer shelf life of cabbage.
- Method of harvesting also greatly determines the postharvest quality of cabbage.
- Postharvest loss generally commences before harvest in the field.
- Injury during harvesting and subsequent postharvest handling can result in defects on produce and facilitate disease invasion.
- Adequate care is needed right from harvesting in order to maintain optimal quality.

5.1 Maturity indices of cabbage

- Heads are harvested when they attain reasonable size having appropriate varietal shapes.
- Mature heads are compact and do not depressed against finger pressure.
- Immature cabbage heads are loosely formed and depressed against finger pressure.
- Premature heads could be harvested for early market and higher profit.
- Over mature or immature heads should not be harvested because they lack proper nutrition and postharvest quality.

5.2 Methods of harvesting

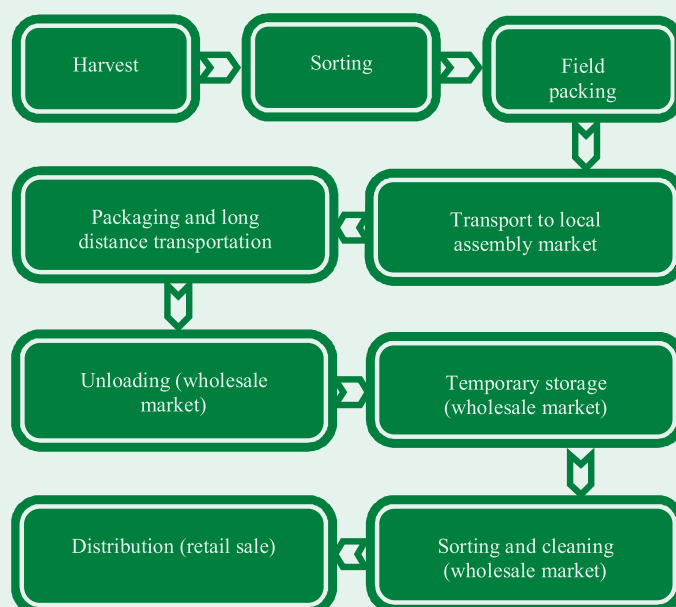
- The optimal time of cabbage harvesting is morning because of prevailing low temperature

with high humidity and absence of scorching sunshine.

- Cabbage field should not be over moistened during harvesting.
- Prior to harvesting insect damaged and yellowish outer leaves should be removed.
- Heads to be cut using a sharp Secateurs or knife leaving one inch of the stem.
- Harvested heads to be held in clean container like plastic crates or plastic buckets and quickly transfer to packing shed.
- Harvested heads do not be left on soil which may contaminate with harmful microbes, dirt or heavy metals.
- It is suggested not to use bamboo baskets to avoid bruising by the sharp edges of the baskets which causes rapid quality deterioration.
- Considering the existing reality bamboo baskets can be used with proper lining materials like newspaper or soft clothes etc. to reduce damage during transportation.

6 Postharvest handling

The present status of postharvest handling of cabbage is still sub-standard. The following postharvest stages are generally observed for cabbage in Bangladesh.



Marketing of cabbage

- Growers sell cabbage to either ‘*Faria*’ (small scale primary trader) in their own field or to ‘*Bepari*’ (large scale primary trader) of the nearby rural assembly markets.
- In the assembly market, cabbage is then loaded onto the transport vehicle (open truck) and carried to the different wholesale markets in the big cities and other district towns based on demand.
- From the wholesale markets cabbage are distributed to the various retail outlets.

6.1 Local transportation

- Bicycle or van or other local vehicles are suitable to carry cabbage heads from field to growers’ house and local assembly markets.
- For transporting to nearby markets cabbage heads to be held in bamboo baskets or plastic sacks or jute sacks.
- Improved packaging i.e. use of plastic crates to carry cabbage heads from the field to the packing shed or local assembly markets need to be practiced so as to reduce postharvest losses and maintain quality.

6.2 Pre-cooling

- Pre-cooling is an important postharvest practice which helps maintain quality and extend shelf life of cabbage.
- Heads to be brought to packing shed at low temperature to remove field heat that helps to extend shelf life of cabbage.
- Growers are strongly suggested to hold harvested cabbage under shade and cool place of their house prior to or during packaging in sacks and transporting to the local assembly markets.

6.3 Sorting

- During sorting insect infested, diseased, rotten, damaged and bruised heads should be removed.
- Sorting should be practiced in cool place of packing shed.
- Since growers of Bangladesh have no structured packing shed they are suggested to

perform sorting operation in cool and shady place of their house or in the field to maintain postharvest quality.

6.4 Grading

- Growers are suggested to grade cabbage into large, medium and small for the convenience of the buyers.
- Prior to grading, the older outer leaves should be removed leaving only 3-4 intact wrapper leaves.
- Insect damaged, diseased, yellow and older outer leaves should be removed during grading.

6.5 Packaging

- For local transportation heads to be packed in jute bags or plastic bags or bamboo baskets.
- The packaging materials should be intact and clean to prevent contamination by microorganisms, insects and heavy metals.
- Paper or plastic liners could be used inside the crates to minimize injury and weight loss.

6.6 Long distance transportation

- Care should be taken during cabbage loading for long distance transportation with packaging materials like paper or soft clothes to minimize damage due to compact, vibration and internal heat generation.
- The best option of transportation of cabbage is the use of refrigerated transport vehicle.

6.7 Measures for transportation

- Transport vehicle should not be overloaded.
- Cabbage should not be mix-loaded with other high ethylene liberating fruits like bananas, tomatoes, papaya, etc, which results in leaf discolouration and reduce shelflife of cabbage.
- Strong and durable packages should be used.
- Packages or containers should be aligned properly.
- Vibration damage should be reduced by using plastic crates, liners and padding.
- Ventilation should be ensured to prevent heat generation during transportation.

- Rough handlings during loading and unloading should be avoided and workers should not stand upon the produce.
- The entire load should be covered with light-colored and thick canvas.

6.8 Storage

Short and long-term storage is the most important postharvest operation in horticultural supply chain. Delay in storing cabbage in proper conditions after harvest result in rapid deterioration in quality. Poor control of storage conditions and storage for too long period may result in poor quality product. In the developed countries, adequate storage facilities are ensured at different levels of marketing from source to shelf.

- Cabbage to be stored in proper conditions soon after harvest.
- Cabbage can be stored at 0oC and 98-100% RH for 3-6 weeks.
- In modified atmosphere (MA) using various types of plastic packaging (low density polyethylene, polypropylene bags, plastic film) to be used to wrap whole or cut cabbage to prolong their shelf life.
- Modified atmosphere storage in combination with low temp. may be suggested for more effective shelf life.

6.9 Measures for storage of cabbage

- Cabbage to be stored after harvested at proper maturity stage.
- Recommended temperature and relative humidity should be maintained.
- The storage room should not be overloaded.
- Adequate ventilation in storage rooms should be ensured.
- The storage room should always be kept clean.
- Ethylene sensitive commodities like banana, pineapple tomatoes, papaya etc. should not be held with cabbage.
- Produce should regularly be inspected to sort out damaged produce.

Farming Systems Research and Development Sub- project

The Sponsored Public Goods Research (SPGR) Coordinated Sub-project on *Farming Systems Research*

and Development for Farmers' Livelihood Improvement was coordinated by Crops Division, BARC and implemented by NARS Institutions viz. BARI, BRRI, BJRI, BSRI, BINA, BLRI, BFRI (Fish) and BFRI (Forest). The goal of the project was to develop farming systems technologies to maximize productivity and efficient utilization of resources. The project was commenced with a holistic approach that includes the integration of different components of farming systems like crops, livestock, fisheries, agro-forestry and homestead agro-forestry. Different site activities include: site characterization, development of sustainable cropping pattern(s), improvement of existing livestock production systems, improvement of fish production systems, development of homestead vegetables production and agro-forestry systems.

A National Task Force Committee was formed to oversee the FSRD project activities. Coordination meeting and progress review workshop were organized as per project proposal and the proceedings of each workshop were distributed among the participants for necessary action. Several field visits were organized by BARC Coordination Unit to monitor the progress of FSRD activities at farmers' level. After each visit, trip report along with comments and suggestions was prepared and sent to the concerned Principal Investigators for necessary action. Procurement of capital items had been completed as per project proposal. BARC-component of FSRD Sub-project did not conduct experiments in the farmers' fields. However, as a Coordination Unit facilitated the work activities of different participating organizations. Major activities that had been performed by BARC Coordination Unit for proper implementation of the project activities during July 2013 to June 2014 are delineated below:

To monitor the progress of FSRD activities at farmers' level, BARC Coordination Unit visited different FSRD sites of participating institutes. In this connection, several visits were made by the project coordinator, associate coordinator, PI and the technical staff during July 2013 to June 2014. Before visiting the sites, the visiting team sit together with the site level working scientists and associated field staff and discussed the purpose of the visit. During field visit observations were recorded and the participating farmers were interviewed to know their reactions about FSRD activities. Comments / suggestions were made based on field observations and are incorporated in the trip reports and sent to the respective PI of the participating organizations for necessary action.

Pictorial View of Field Monitoring



Field monitoring at sylhet



Field monitoring at Rajshahi



Field monitoring at Sherpur



Field monitoring at Gouripur, Mymensingh



Field monitoring at Sherpur



Field monitoring at Tangail

Two coordination meetings on Farming Systems Research and Development (FSRD) were organized by Crops Division on 02 July 2013 and 17 November 2013, respectively at the conference room-1 of Bangladesh Agricultural Research Council. The coordination meetings were held to review the progress of the different components of the sub-projects activities and to discuss the research program of 2013-2014 Rabi seasons. All Principal Investigators (PIs) of FSRD Sub- project were present in these meetings. Decisions made by the house were sent to all the PIs for necessary action.

Progress review workshop and project completion workshops were held during the 2013-14 FY. Project completion workshop was held on 14-15 May 2014. About 70 agricultural scientists including project Coordinator and all PI and Co-PI of the sub-project and relevant scientists were present in the workshop. The livelihood improvement so far achieved through the sub-project activities were thoroughly discussed in the workshop. Guidelines and necessary information regarding Project Completion Report (PCR) preparation were also discussed in the workshop.

Monitoring of the research programme

SPGR projects under NATP phase - I: Forty three SPGR sub projects under crops desk monitored. A few of them also monitored at field level specially SPGR Sub-project on “Farming Systems Research and Development for Farmers’ Livelihood Improvement” at FSRD sites Rajshai, Rangpur, Barisal, Patuakhali of BARI and FSRD site Barisal of BRRI.

Core research programme: As a team member (formed by Planning and Evaluation division, BARC) the scientists of crops division have visited some projects at field level implemented under research grant fund of BARC and report submitted to P&E division of BARC.

Date of visit: 13-15 February 2014 (03 projects)

(1) Soil water and nitrogen management for sustainable crop production using tracer technique in drought prone areas of Bangladesh, (2) Development and dissemination of a low cost power tiller operated potato planter and (3) Improvement of gladiolus quality and its adaptation.

Date of visit: 03 March & 30 March 2014 (SAU, Dhaka and BARI & BSMRAU Joydebpur (5 projects)

(1) Evaluation of New Plant Type (NPT) advanced lines of rice for Amon season as high yielding varieties; (2) Influence of fertilizer, manure and water management on soil fertility, nutrient availability and productivity under Rice-Rice cropping system; (3) Development of Gynodioecious Papaya Variety; (4) Integration of fish culture with hydroponic agriculture system for alternate rural livelihoods; (5) Export and Import Analysis of Selected Vegetables and Spices in Bangladesh.

Date of visit: 05 and 11 February 2014 (BARI, 5 projects)

(1) Improvement of gladiolus quality and its adaptation; (2) Development of technology for production of seedless fruits of guava and lemon (*Mini Elachi Lebu*) in off season; (3) Integrated Management of Banana Diseases caused by Fungi and Nematode; (4) Development of packages for fruits (mango, banana) and vegetables (yard long bean, pointed gourd, okra); (5) Study on Rural Household’s Food Security in Coastal Region of Bangladesh.

Monitoring Team-7, Dr. S. M. Khalilur Rahman, Member Director (AERS), Team Leader, Dr. S. M. K. Alam, PSO (Crops) and Md. Mostafizur Rahman, Senior Training Officer were members of the group. They monitored the following projects under BARC Core funded projects during 13-15 February 2014.

- 1) Development and dissemination of a low cost power tiller operated potato planter
- 2) Soil Water and Nitrogen Management for Sustainable Crop Production Using Tracer Technique in Drought Prone Areas of Bangladesh
- 3) Improvement of gladiolus quality and its adaptation.

National and International Linkages (MoU/ Bilateral agreement, Collaborative Work plan signed during the year. Highlights of activities undertaken under the MoU/Agreement, etc.

- A report on “Bangladesh-Thailand 6th Joint Economic Commission” held on 2-4 November 1998, Bangkok, Thailand was sent to MoA on 8 July 2013.
- Opinion on establishment of bilateral relationship between Bangladesh and EMBRAPA with tentative budget was sent to MoA on 21 July 2013.

- Opinion made on draft MoU between Bangladesh and Zambia for agricultural cooperation and sent to MoA on 27 September 2013.
- Brief & Talking points prepared and sent to MoA for 2nd Senior Officer Level Meeting to be held in South Africa on 25-26 November 2013 (sending date to MoA was 6 November 2013).
- Draft MoU between Ministry of Agriculture/BARC and Republic of Guinea for bilateral cooperation in the field of agriculture was prepared and sent to MoA on 30 September 2013.
- Draft MoU between Bangladesh and Kuwait for bilateral cooperation in the field of agriculture was made and sent to MoA on 19 August 2013.
- The MoU between Bangladesh and Cambodia for bilateral cooperation in the field of agriculture was signed on 17 June 2014 at Honble Prime Minister's office, Dhaka.
- Draft MoU between Bangladesh and Malaysia was prepared and sent to MoA on 10 November 2013.
- Training proposal at Malaysian Agriculture Research and Development Institute (MARDI) was sent to MoA on 31 December 2013 for the implementation of decisions of 3rd Joint Commission Meeting between Bangladesh-Malaysia.
- Opinion made on "Prospects of Grape & Saudi Date palm cultivation in Bangladesh for Bangladesh Bank" was sent to MoA on 7 November 2013.
- Brief & Talking points prepared for 11th Joint Economic Commission Meeting between Bangladesh and Saudi Arabia to be held in Dhaka, Bangladesh on February 2014 and sent to MoA on 22 January 2014.
- Inputs made for forthcoming bilateral meeting between Bangladesh and the Philippines to be held in Manila, Philippines during January, 2014 and sent to MoA on 27 January 2014.
- Inputs made for forthcoming bilateral Safety dialogue between Bangladesh and Myanmar and sent to MoA on 27 January 2014.
- Inputs made for forthcoming 5th JEC between Bangladesh and Iran to be held during 5-6 May 2014 and sent to MoA on 2 February 2014.
- Commented on Progress on Bangladesh-Iran 5th Joint Economic Commission Meeting and sent to MOA on 6 February 2014.
- Commented on the proposed MoU between Bangladesh and Chile on Sanitary and Phytosanitary Matters & sent to MoA on 2 March 2014.
- Prepared draft MoU between Bangladesh and South Africa and sent to MoA on 29 April 2014.
- Opinion given on draft Agreement on Bangladesh-Indonesia Scientific and technological cooperation and sent to MoA on 4 May 2014.
- Opinion made on proposed MoU between Bangladesh and Chile on "Sanitary and Phytosanitary Matters" and sent to MoA on 4 May 2014.
- Inputs given for 8th Annual Foreign Ministerial Review Meeting between Bangladesh and Myanmar in the Field of Agriculture and sent to MoA on 18 May 2014.
- Inputs given for discussion during visit of Indian Foreign Minister and sent to MoA on 17 June 2014.

TECHNOLOGY TRANSFER MONITORING UNIT

POLICY LEVEL CONTRIBUTION

Divisional scientists participated in different policy meeting, seminar, workshop and given their valuable comments. Different policy oriented comments were also sent to the Ministry of Agriculture according to their needs/requirements. Input of BARC on *Technologies Facilitation for Sustainable Development* was given.

Monitoring and evaluation report of Programs/ Activities of NARS Institutes

Dr. Fauzia Yasmin, PSO, TTMU participated in the field monitoring of Core Research program during February 11 to 13, 2014. Under its monitoring trip the following projects have been evaluated:

- Study on fish disease and health management in rural aquaculture
- Study of reproductive endocrinology of mud eel *monopterus cuchhia* for artificial propagation

- iii. Production of genetically male tilapia by identification of YY supermales using micro-satellite DNA markers
- iv. Development of breeding and fry rearing techniques of endangered tengra, *Mystus vittatus agulsha*, *Mystus cavasius*
- v. Collection of some targeted threatened plant species of sylhet forests for sustainable management and curation
- vi. Increasing nitrogen use efficiency through nitrogen and water management in the rice-rice cropping pattern
- vii. Epidemiological investigation of anthrax and determination of efficacy of local anthrax vaccine in Bangladesh.

TTMU has conducted four Training of the trainers (ToT) in different institutes covering various crops. The institutes covered under this ToT are as follows:

- i. Cotton Development Board
- ii. Bangladesh Sugarcane Research Institute, Ishurdi
- iii. Bangladesh Jute Research Institute (BJRI), Dhaka
- iv. Bangladesh Sericulture Research and Training Institute (BSRTI), Rajshahi.

ToT at Cotton Development Board

A 3-day long training programme on newly developed technologies on cotton was organized by TTMU, BARC during 11-13 March 2014 at CDB. The objective of the training Programme was to update the knowledge and skill of Upazilla Agricultural Officers on cotton. Thirty Upazilla Agricultural Officers' of DAE from different cotton growing areas were attended in the training Programme. Scientists of CDB acted as resource persons on the training course. Ten technologies were included in the training schedule. Dr. Md. Kamal Uddin, Executive Chairman, BARC was attended as Chief Guest and Md. Abdul Latif, Executive Director, CDB chaired the inaugural session of the training programme. Dr. Fauzia Yasmin, PSO (TTMU) coordinated the training programme.

ToT at Bangladesh Sugarcane Research Institute

A 3-day long training programme on newly developed technologies on Sugarcane was organized by TTMU, BARC during 27-29 April 2014 at BSRI. The objective

of the training Programme was to update the knowledge and skill of Upazilla Agricultural Officers on sugarcane. Thirty Upazilla Agricultural Officers' of DAE from different Sugarcane growing were attended in the training Programme. Thirty Upazilla Agricultural Officers' of DAE from different cotton growing areas were attended the training Programme. Scientists of BSRI acted as resource persons on the training course. Ten technologies were included in the training schedule. Dr. Eusuf Zai, Director (T&T), BSRI was attended as Chief Guest and Dr. Md. Humaun Kabir, the Director General chaired the inaugural session of the training programme. Dr. Fauzia Yasmin, PSO (TTMU) coordinated the training programme.

ToT at Bangladesh Jute Research Institute

A 3-day long training programme on newly developed technologies on Jute was organized by TTMU, BARC during 6-8 May 2014 at BJRI. The objective of the training Programme was to update the knowledge on Jute.. Scientists of BJRI acted as resource persons on the training course. Ten technologies were included in the training schedule. Dr. Chandan Kumar Ray, Director (Training), BJRI was attended as Chief Guest and Dr. Md. Kamal Uddin, Executive Chairman, BARC as well as Director General, BJRI chaired the inaugural session of the training programme. Dr. Fauzia Yasmin, PSO (TTMU) coordinated the training programme.

ToT at Bangladesh Sericulture Research and Training Institute

A 3-day long training programme on newly developed technologies on Jute was organized by TTMU, BARC during 11-13 May 2014 at BSRTI. The objective of the training Programme was to update the knowledge and skill of Upazilla Agricultural Officers on sericulture. twenty Upazilla Agricultural Officers' of DAE from different Jute growing areas were attended the training Programme. Twenty Upazilla Agricultural Officers' of DAE from different sericulture potential areas were attended in the training Programme. Scientists of BSRTI acted as resource persons on the training course. Eighteen lectures of five technologies were included in the training schedule. Mr. Sawpan Kumar Paul Director General, Bangladesh Sericulture Development Board was attended as Chief Guest and Dr. Jamal Uddin Shah (DS), Director, BSRTI, Rajshahi chaired the inaugural session of the training

programme. Dr. Fauzia Yasmin, PSO (TTMU) coordinated the training programme.

Besides, the officer of the unit participated in a good number of training, workshops, seminars etc. during the period.

PLANNING AND EVALUATION

Project Implementation/Project Management

The Project Implementation Unit (PIU) of Bangladesh Agricultural Research Council is implementing the research component of National Agricultural Technology Project. This component is coordinated by Planning & Evaluation Division. A total of 108 Sponsored Public Goods Research (SPGR) sub-projects in selected identified thematic areas were being implemented at different NARS institutes and public universities of the country. Planning and Evaluation Division, with the assistance of the other divisions, is also monitoring the SPGR sub-projects.

Planning and Evaluation Division of BARC has been developed a Technical Assistance Project Proposal (TPP) titled *Adaptation to Climate Change and Rehabilitation of Livelihood in South West of Bangladesh (CLAP)* for funding from German Development Corporation (GIZ). The German Government has morally accepted the project concept and the Technical Assistance Project Proposal (TPP) of the project is now under approving.

A seven member Proposal Evaluation Committee (PEC) under the provision of Public Procurement Regulations 2008 was formed comprising Dr. Meraz Uddin Ahmed, Member-Director (Administration and Finance) as Chairperson. Among others Dr. Paresh Chandra Golder, Member-Director (Planning & Evaluation), BARC as a member made major contribution in recruiting the National Core and Short-term Consultants for the National Agricultural Technology Project (NATP)-Phase-I and also in the Agricultural Research Management Information System (ARMIS) project.

Research Management and Coordination

To facilitate research and technology transfer, the Bangladesh Agricultural Research Council is providing research grants to various public organizations since 2004. During the fiscal year 2013-14 the Planning and

Evaluation coordinated the 38 research programmes of the NARS, and Agricultural universities through funding of the core research and human resource development. Further, the Planning and Evaluation division organized frequent review and desk/field monitoring for its success. With the approval of the Executive Council of BARC, an amount of Taka 140.00 lakhs was provided to these research programmes. Findings of the completed projects implemented through different organizations are briefly described below:

Bangladesh Agricultural Research Institute

Improvement of gladiolus quality and its adaptation: The study was conducted at Floriculture Farm, Horticulture Research Centre, BARI, Joydebpur, Gazipur during the period from November 2013 to May 2014 to find out the performances of ten gladiolus lines. Various concentrations of GA₃ showed significant effect on the days to 50% spike initiation, spike length, rachis length, number of florets per spike, flower yield and vase life. All concentrations of GA₃ significantly improved the characteristics of gladiolus over control, while the most effective concentration was 200 ppm GA₃. Large size corms were found to show better performance than small size corm in respect of all parameters. However, the treatment combination of GA₃ at 200 ppm and large size corm showed best performance in respect of flower production of gladiolus. It was also noticed that B and Zn both either in single or in combination exerted tremendous effect on the yield and quality of gladiolus. However, with subsequent addition of higher rates of B and Zn progressively increased the selective growth and flower characters to some extent and be the further increment of the dosage declined the results noticeably. The sixteen treatment combinations included in the study noted that B and Zn at B_{2.0} Zn_{3.0} kg ha⁻¹ along with blanket dose of N₃₇₅ P₁₅₀ K₂₅₀ S₂₀ kg and CD 5 t/ha⁻¹ exhibited the best performance in flower production and stretched the vase life. The test parameters like plant height, length of spike, length of rachis significantly responded to the combined application of boron and zinc at the rate of B_{2.0} and Zn_{3.0} kg/ha respectively as compared to other treatment combinations. Floral characters like floret number, vase life and flowers yield also significantly influenced by said treatment (B_{2.0} Zn_{3.0} kg ha⁻¹) which was markedly different over rest of treatments combination. Similar results were found as well in single application of B and Zn with increased rates. The BARI Gladiolus-1 and

BARI Gladiolus -3 varieties showed better performance and produced higher yield all locations. But the demand of BARI Gladiolus-3 was more than BARI Gladiolus-1 depending on the consumer's choice, preference and economic value. The study concluded that GL-002, GL-012, GL-025 and GL-037 found promising genotypes for selection on the basis of its flower characters such as attractive colour, early flowering, maximum number of florets, longest spikes and rachis, highest weight of spike, longest shelf life, etc.

Development of technology for production of seedless fruits of guava and lemon (Mini Elachi Lebu) in off-season: An experiment was conducted at BARI, Gazipur during 2013-14 on mini *elachi lebu* with a view to produce seedless fruit. GA₃ was applied at the rate of 0, 50, 100, 200 and 300 ppm at four distinct stages viz., 1, 2, 3 and 4 weeks after flower bud initiation. GA₃ was applied in the month of September 2013. Results revealed that no seedless fruit was obtained except GA₃ applied at the rate of 300 ppm at one week after flowering. Simultaneously the flower bud which initiated within fourteen days after GA₃ (200 and 300 ppm) induced seedless fruit. Accordingly GA₃ was applied at the rate of 0, 200, 300 and 400 ppm 1 and 2 weeks before flower bud initiation and one week after flower bud initiation on January 2014 for more confirmation. In case of *Kazi peyara*, higher concentration of GA₃ (300, 400, 500, 750 ppm) were applied on October 2013. Fruits are in developing stage.

Evaluation of Short Duration High Yielding Rapeseed-Mustard Varieties/Lines for Cultivation between T.Aman and Boro Rice: Bangladesh is suffering from acute shortage of edible oil for several decades. It becomes severe with the increase of population pressure and reduction of cultivated lands. Only 29% of her total requirement is met up by domestic production and rest of the 71% has to import from abroad. It is necessary to boost up local production for reducing dependency on import from foreign country and to check the volatile market of edible oil in Bangladesh. Development of short duration high yielding varieties and cultivate them between T. Aman and Boro rice which is the major existing cropping pattern in our country is the easiest way to increase domestic production. Keeping it in mind, the project," Evaluation of short duration high yielding rapeseed- mustard varieties/ lines for cultivation between T. Aman and Boro rice" has been

initiated to enhance local production of *Brassica* edible oil. T. Aman-Mustard-Boro cropping pattern has been conducted at 10 farmers' field in Jamalpur and Sherpur districts. BINAdhan 7 was transplanted at the ten selected farmers' field in Aman season. It was observed that the yield of this short duration rice variety varied from 2668-3557 kg mon/has and average yield was 2964 kg/ ha. As it is an early variety, farmers could easily cultivate rapeseed mustard after harvest of T. Aman. In Rabi season, two sets of experiments were initiated at the same area in the ten farmers' fields just after harvest of BINA dhan 7. Set-1 was comprised of 8 promising lines of *Brassica campestris* including BARI Sharisa 14 and Tori-7 as checks. Similarly, set-2 was comprised of 8 promising lines of *Brassica napus* including BARI Sharisa 8 as check variety. All these lines of rapeseed were selected on the basis of their previous evaluation at RARS, Jamalpur in last year. The seedling of boro rice is ready now for transplantation and it will be done after harvest of rapeseed mustard.

Integrated Management of Banana Diseases Incited by Fungi and Nematode: Integrated Management of Banana Diseases incited by Fungi and Nematode passed by BARC from July, 2011 but the project activity was started from November 2011 with survey of panama disease. Little progress was done during last year and this year also as for symptom development in the orchard old plantation is necessary. Only three popular banana growing areas such as Mithapukur, Rangpur; Sibganj, Bogra and Pirojpur Sadar were surveyed for panama in December-January period where the disease incidence was found 7.2, 6.3 and 13.0% respectively. The infestation of other diseases like sigatoka, bunchy top and mosaic was also found low during the survey. The collected pathogen of panama was purified and stored for future use. Panama disease incidence of banana cultivars in Bangladesh varied widely location-wise and the cultivated cultivars like sabri, champa and cooking banana seemed to be more susceptible to panama disease compared to Amritasagar or Mehersagar. The incidence of nematode was found as negligible in the survey areas.

Up Scaling of Summer Onion Bulb and Seed Production Technology at Farm Level: Bangladesh Agricultural Research Council has coordinated a project titled up scaling of BARI released summer onion bulb and seed production technology for increasing summer onion bulb and seed production in working site Sadar Faridpur and Sadar Rajbari district

under the supervision of On-Farm Research Division (OFRD), BARI, Faridpur. The objective is to disseminate knowledge among the selected growers about summer onion varieties and their production technology on summer onion bulb and seed production, to develop post harvest technology like bulb storage for use in true seed production, to identify the constraints for dissemination this technology. As, it is a technology transfer programme, we have stressed on selection of advanced farmers, providing training for farmers, conducting of production programme in farmers field, arranging field day for farmers' motivation. For upgrading the knowledge of farmers, eight out of nine farmers training program was accomplished since 2011-2014. About 240 farmers of Sadar Faridpur and Sadar Rajbari were trained up for bulb and seed production. Results from 2012-13 and 2013-14 revealed that, yield of summer onion bulb in *kharif* II showed higher than that of *kharif* I season irrespective of varieties. Again, yield showed higher in Faridpur than that of Rajbari. Three varieties (BARI Piaz 2, BARI Piaz 3 and BARI Piaz 5) showed reasonable yield. In *kharif* I season at Faridpur, mean yield of two years (2011-2012 and 2012-13) of BARI Piaz 2, BARI Piaz 3 and BARI Piaz 5 was 12.27 t ha⁻¹, 13.60 t ha⁻¹ and 14.18 t ha⁻¹, respectively and at Rajbari, it was 11.60 t ha⁻¹, 10.27 t ha⁻¹ and 11.04 t ha⁻¹, respectively. In *kharif* II season of two year average at Rajbari, mean yield of BARI Piaz 3 and BARI Piaz 5 was 13.75 t ha⁻¹ and 15.98 t ha⁻¹, respectively. Yield showed higher in *kharif* II than *kharif* I due to higher life duration in *Kharif* II than *Kharif* I. Seed production was not satisfactory and that might be due to the lack of pollination, natural hazard etc. Average seed yield of two years (2011-12 and 2012-13) of BARI Piaz 5 was 91 kg ha⁻¹ whereas BARI Piaz 3 gave 75 kg ha⁻¹. Five field days out of 6 field days was arranged successfully in 2011-2013. About 500 farmers of different categories were participated. However, in season of *Kharif* II, 2013 bulb production of BARI Piaz 3 and 5 were transplanted in 5 sites of Faridpur and Rajbari. The almost of all sites were harvested and average yield was 30-36 t ha⁻¹. For seed production in *rabi* 2013-14 and *kharif* I 2014 for bulb production, yield report of bulb and seed production will be done after June 2014.

Export and Import Parity Analysis of Selected Vegetables and Spices in Bangladesh: The study was undertaken to find out export potentialities of selected vegetables and import substitution. A total of 480 vegetables (40 for each vegetables and each location)

and 240 spices growers (40 for each location), 25 suppliers and 25 exporters were randomly selected for the study. Cost and return analysis was done on both variable and total cost basis. Domestic resource cost (DRC) was also estimated for evaluating the comparative advantage of selected vegetables and spices. The study revealed that the net margins of producing vegetables and spices were found positive. However, higher net margin was estimated for brinjal producers (Tk 2,73,799/ha) followed by ginger producers (Tk 2,31,399/ha). Comparatively lower net margin was calculated for potato producers (Tk 59,758/ha) than garlic producers (Tk 99,352/ha). Again, higher net margin was calculated for vegetables exporters of Tk 33,935/ton at UK and Tk 23,952/ton at Middle East markets followed by vegetables suppliers (Tk 2,437/ton). The highest benefit cost ratio was for ginger (2.1) followed by brinjal (1.9), ash gourd (1.8) and cucumber (1.7). The estimates of DRC showed that Bangladesh had comparative advantage in bitter melon, pointed melon, ash melon, cucumber, brinjal and potato production as these estimates were less than one and DRC for onion, garlic and ginger were also less than unity implied that the production of these spices would be highly efficient for import substitution.

Development and dissemination of a low cost power tiller operated potato planter: The improved potato planter was demonstrated on station of Regional Wheat Research centre, Shyampur, Rajshahi and in the farmers field of Sibpur, Puthia Baripara, and Pakuria, Pabna of Rajshahi district in during 22-29 November 2013. Nine farmers field was demonstrated the potato planter. Both whole tuber potato seed and cut piece potato seeds were used. The potato planter acts as furrow making, placing whole tuber seeds in pre-determined distance (20 cm) with regular interval and earthing up simultaneously. For cut piece seeds, the distance was 15-17 cm. It creates a trapezoidal bed shape, bottom width 55 cm and top 40 cm. Uniformity of seed spacing was 95-97% and missing seed for whole tuber seed 2-3% and for cut piece seeds 5-6%, respectively. Potato planter saved labour cost by 75% compared to conventional manual planting method. Two manufacturers start fabrication of potato planter.

Development of packages for fruits (mango, banana) and vegetables (yard long bean, pointed gourd, okra): The experiment was carried out to evaluate the effect of plastic/wooden crates and packaging materials on the quality and shelf life of pointed gourd during transportation and storage using

passive modification of modified atmosphere packaging system. The modified atmosphere was created by making perforation in the polypropylene packets. Pointed gourd pre-treated with chlorine water (200ppm chlorox/halotab, 2 tablets per 1.5 litre water) and then transportation in wooden or plastic crates and packaging and storing in 1.2% perforated polypropylene packets resulted substantial reduction in losses due to physiological weight loss and rotting/shriveling and retained considerable marketable quality. These treatment combinations also considerably retained vitamin C and A (β -carotene). Under this condition the retention of quality and shelf life of pointed gourd could be extended up to 10 days at ambient condition as compared to non-treated and without packaging.

Study on Rural Households' Food Security in Coastal Region of Bangladesh: The study was conducted in six coastal districts namely Khulna, Bagherhat, Satkhira, Patuakhali, Bhola and Barguna of Bangladesh during the period of 2012-13 to 2013-14. The study focused on the status of food security and its determinants among coastal people in study areas and identified their livelihood risks and coping strategies during stressed situations. A total of 900 coastal households revealed that most households (53%) were food secured whose calorie intake (2795 kcal/capita/day) was much higher than the national average (2318 kcal/capita/day). Among various food items, rice supplied 71.32% of the total daily calorie intake of food secured households followed by, edible oil 7.74%, sugar (5.68%), potato (3.68%), vegetables (4.33%), pulses (2.45%), and spices (1.59%). Logit model revealed that farm land size, farm income, off-farm income, and household crop production had positive and significant impact in attaining food security of the coastal households. Besides, small households and the households with more earning member were more food-secured than large ones. Flood, heavy rainfall, reduction of land productivity, crop damage by rat, lack of modern technology, salinity and high price of inputs were found to be livelihood risks for the coastal households. They used previous savings, own assets sale; sale of poultry, reduce adult consumption to support children; sale of livestock; moved elsewhere to find work; borrowed money from relatives or others; received help from institution (NGO, religious, govt., etc.); sale of local labour and fishing during different stressed situations.

Development of Population for Gynodioecious Papaya Variety: The study to develop gynodioecious population for papaya variety containing 100% productive plant and to increase farm income through papaya cultivation was carried out at the Fruit Research Farm of Pomology Division, HRC, BARI, Gazipur. Sixteen germplasm from home and abroad were collected and included in the study. After flowering, only 22 plants were noticed as andromonoecious type. Among them 9 plants have been selected as superior in terms of yield and taste. Seeds of F1 progeny have been sown in seed bed on December 2013. Collection of new germplasm will be continued.

Bangladesh Jute Research Institute

Improvement of jute based cropping pattern & jute seed production techniques in southern areas of Bangladesh: The study was undertaken to assess agro-economic performance of different of allied fibre varieties in the coastal salinity areas of Kalapara & Dumki under Patuakhali district and Amtali under Barguna district. Among different jute and allied fibre varieties HC-95 performed better in aspects of yield, gross return; gross margin as well as BCR. Under the experiment "Performance of jute seed production with winter vegetables in southern areas of Bangladesh", four cropping pattern were studied like Jute seed as a sole crop (T_1), Jute seed + Lalshak + Radish (Broadcast method) (T_2), Jute seed + Lalshak + Radish + Tomato (Line sowing with three pair method) (T_3), Jute seed + Lalshak + Tomato + Brinjal (Line sowing with three pair method) (T_4). Among the four cropping pattern, the maximum yield of jute seed was observed from jute seed as a sole crop 880 kg/ha and 435 kg/ha in Kalapara and Amtoli respectively. The benefit cost ratio (BCR) on full cost basis ranges from 1.09 to 4.51. Other experiments performance of alternative cropping pattern (FA) Mungbean-Jute-T.aman were tested against farmer's pattern. In farmer's pattern, jute is incorporated as an additional crop. The yield of jute in FA pattern was 2155 kg/ha with gross return (126300 Tk/ha) and BCR 1.66.

Bangladesh Institute of Nuclear Agriculture

Development of short duration high yielding boro rice varieties through induced mutation:

Two experiments were conducted to develop late transplanting potential, short duration and high yielding boro rice variety(s) that can be transplanted after harvest of high yielding mustard/rapeseeds and to develop boro rice variety(s) with higher yield potential than BRRI dhan29 with earlier or similar maturity. The first experiment included two mutant lines and the second experiment 06 mutant lines. In the first experiment, seeds were sown 09 to 29 January and transplanted during 22 February to 08 March 2013 at 12 different locations of Bangladesh. In most of the locations, transplantation was made after harvest of long duration mustard/rapeseed. In the second experiment, seedlings were sown during 08 to 26 January and transplanted during 24 January to 26 February 2013 at four different locations. Both the experiments followed RCB design with 3 replications. Based on the performance of 11 locations, and the opinion of research, extension and BADC people it can be concluded that the rice mutant RM (1)-200-(C)-1-17 is more suitable for late transplanting after harvest of long duration mustard/rapeseed as produced 17.04% more yield than BRRI dhan28 and also possess shorter plant height, lodging resistance, erect plant and leaves, shorter duration, and similar grain quality as the check variety. In the second experiment, the rice mutant RM (2)-40(C)-1-1-10 which produced comparable yield and matured 09 days earlier than the check variety BRRI dhan29.

Soil Water and Nitrogen Management for Sustainable Crop Production Using Tracer Technique in Drought Prone Areas of Bangladesh:

An isotope aided field experiment was carried out with wheat during the year of 2011 at drought prone area, Godagari Upazilla, Rajshahi, Bangladesh. The experiment was conducted in a two factor split-plot design with 3 replications and the objective of the experiment was to improve the N use efficiency in wheat with a view to minimum water use in drought prone areas. Three irrigation treatments; W_1 = Irrigation as Farmers practice; W_2 = Two irrigations (at CRI and before flowering /anthesis stage of wheat) and W_3 = Three irrigations (at CRI, flag leaf ligule emergence and before flowering /anthesis stage of wheat) were assigned in the main plots and four N treatments; N_0 = No nitrogen (control); N_1 = 50kg N/ha, N_2 = 100kg N/ha and N_3 = 150kg N/ha were assigned in

the subplots. For isotopic study, ^{15}N labeled nitrogen fertilizer (10.48% a.e.) was applied in the isotopic micro-plot. The initial soil samples were collected from the experimental field for determining the physico-chemical properties of the existing soil. Field data on the different yield and yield contributing characters of wheat were recorded and analyzed statistically. Soil and plant samples were collected from both isotopic and non-isotopic plot for laboratory analysis. Considering the grain yield the highest yield was observed in the treatment combination W_3N_2 (4.97 t/ha), which is closely followed by treatment combinations W_2N_2 (4.09 t/ha), W_3N_3 (4.36 t/ha) and W_1N_3 (4.02 t/ha). Similar results were noticed in case of straw yield of wheat and the maximum and minimum values were recorded in the treatment combination W_3N_2 (6.64 t/ha) and W_1N_0 (2.74 t/ha), respectively. Different irrigation and N levels affected on the amount of N uptake in grain and straw of wheat. The maximum N uptake of 75.54 kg/ha was noticed in the treatment combination of W_3N_2 , whereas, the minimum value (27.05 kg/ha) was found in W_3N_0 treatment. Regarding the N uptake in wheat straw, the highest (21.54 kg/ha) and lowest (5.75 kg/ha) values were noticed in the treatment combination of W_3N_3 and W_2N_0 , respectively. From the study, it was observed that due to different irrigation and N levels the amount of total N, SOC and available P showed a variations, which ranged from 0.09 to 0.11% for N, 0.53-0.79% for SOC and 12.35-3.01ppm for available P in the soil during the time of wheat harvest.

Soil Resource Development Institute

Organic Amendments for Upland Crops under Light Textured Soils in Char (OAUCC):

The experimental site was selected in a charland which was located in Charharirampur union under Faridpur district under AEZ-10. The soil was light textured and calcareous in nature. Land preparation, pegging (demarking) of the main plot and sub-plots, weeding were done and protection measures taken accordingly. Cow-dung and poultry litter as organic amendment have applied to the field in the two successive crops with chemical fertilizers following IPNS. All inorganic fertilizers (P, K, S, Zn, B fertilizers) applied in full dose at final land preparation except N fertilizer. N-fertilizer was applied in three splits. Crops selected were BARI Wheat-24 (Pradwip) for Rabi season (winter) and Parijat, a local variety of B. aus for Kharif season. Fertilizer treatments in wheat field were: T_1 [N:P:K:S:B=182.19:24.71:24.71:17.78:3.36kg/ha +

cow-dung=10ton/ha, Farmer's practice]; T_2 [N:P:K:S:Zn:B=140.50:35.50:45.50:18.00:3.35:0.80, Fertilizers application as recommended by FRG]; T_3 [N:P:K:S:Zn:B=136.0:34.0:40.5:18.0:3.35:0.8+Cow-dung=3ton/ha]; T_4 [N:P:K:S:Zn:B=129.0:25.0:38.5:18.0:3.35:0.8kg/ha + poultry litter=1.5kg/ha]. Line sowing was followed for both crops. Irrigation was applied as necessary. The yield wheat was found highest in case of T_2 treated plots (6.11 t/ha) following T_4 treated plots (5.75 t/ha), T_3 treatment (5.25 t/ha) and the minimum from farmer's own practice (T_1 , 4.48 t/ha). Organic amendment with cow-dung (IPNS) and poultry litter (IPNS) increased wheat yield compared to farmer's practice. What positive effect organic amendment made to soil quality is yet to be identified. B. aus paddy was in active tillering stage. A leaflet (project overview) was prepared and multiplied for distribution to farmers and other stakeholders. Fifty farmers were trained on soil sample collection techniques, balanced fertilizer application and the role of organic matter.

Effect of Different Hedge Species on Soil Erosion and Crop Yield at Different Hill Slopes of Chittagong Hill Tract: Chittagong Hill Tracts (CHT) is the largest hilly area located in the southeast of Bangladesh. The region covers an area of about 13,181sqkm. Major agricultural activity in this area is traditional rainfed farming which is locally known as *Jhum* and commonly known as "Shifting cultivation" or "Slash and burn" system. *Jhum* cultivation in hilly areas causes gully erosion and loss of soil ranges from 10 to 120 t ha⁻¹ yr⁻¹. Alley cropping or hedge row cultivation is very helpful in controlling soil erosion in the hilly area. So far very little scientific effort have been taken to test the effect of different hedge species in controlling soil erosion in different slopes of CHT, which could reduce pressure on already squeezed suitable *Jhum* land. If the farmer can harvest more crops from reasonably smaller plot then it will decrease existing *Jhum* coverage, reduce deforestation and improve soil health by reducing soil erosion and runoff. This program was, therefore, designed to select suitable hedge species and their alley width in respect to slope which will minimize soil loss and increase crop yield. In order to perform cataloguing the hedges and their alley were use selected such as indigofera, Bogamedula, Pineapple and Napier. Three different slopes are gentle slope, moderate slope and steep slope. Two different crops like yard long bean and lady's finger were used as test crops. The different alley wind under each hedge species was 5m, 4m and

3m. Each plots containing 3 lines of hedge. The experiment was laid out in split plot design with three replications. Soil erosion were measured through spike lay out method. Fertilizers applied based on soil test value. Collected data were statistically analyzed following MSTAT program. It is concluded that Because of hedge plantation, number of total plants in each managed plot of same alley width and slope gradient is always less than the controlled plot. Difference of total plants in each plot (control & managed by hedge) are directly influenced by alley width. Wider alley width gives a better yield performance. Species of hedge plants have a great effect on plant growth and crop yield. Hedge plant of low height (*pineapple*) provides a better performance than that of higher height hedge plant because it provides intensive light & better rooting. But higher height hedge plant provides more bio-mass than lower height hedge plants. Grass species (Napier) responses better than tree/shrub species (*Bogamedula* & *Indegofera*) on crop yield. Performance of pineapple among all other hedge species on crop yield and soil loss minimizing capacity was recorded the best on all slope gradients & alley width. Hedge always plays a vital role on plant growth, crops productivity, fruit length & weight as well as minimizing of soil erosion. More yields were gained from the managed plots by hedge, though the number of total plant was comparatively less in those plots than the control one. Due to addition of bio-mass & comparatively less soil erosion for hedge plants, nutrient status of soil had maintained for better productivity. Slope Gradients have a most important role on crops yield and soil erosion factor. The highest yields and the lowest soil loss were recorded in gentle slope than those of moderate & steep slope.

Bangladesh Agricultural University

Development of short duration high yielding rice varieties: Rice (*Oryza sativa*), the staple food crop of Bangladesh, covered about 10.58 million hectares of cropped area and total production in the FY 2010-11 was 33.52 million ton, in which the contribution of Aus, Aman and Boro were 2.13 million ton, 12.79 million ton and 18.60 million ton, respectively. The national cropping intensity was 181% during the period 2010-11. More than 94% of the population derives 76% of its daily calories and 66% of its protein needs from rice. Primary constraints to achieving food security are the low yield per unit area and negligible scope for expansion of the area of land for cultivation. Hence,

increase in intensity of cultivation and in yields per unit area are the only available options to meet future food needs to feed an ever increasing population. In Bangladesh, most of the farmers are growing Aus, T. aman and Boro rice annually in many regions of Bangladesh. But the existing field problem of rice cultivation in Bangladesh is lacking in short duration high yielding rice varieties for all seasons. The area of Aus cultivation decreased by about 50% from the year 1990 to 2006 due to lacking in short duration modern varieties. Farmers are reluctant to grow the poor yielding Aus varieties. To address this problem the present study will help to develop high yielding varieties of acceptable grain quality, preferably short growth duration to increase land productivity to 3 crops in a year. The main goal of this research is to develop short duration, stable and high yielding rice varieties for Aus, Aman and Boro seasons to fit into the existing cropping patterns. Breeding line SL-9 and ADT(R) 47 were selected as donor (male) parent and BRRIdhan 52, BRRIdhan 53, BRRIdhan 57 as recipient (female) parent for Aman season and crosses were made among the selected parents. For Boro season, crosses were made in BRRIdhan 28 X IR 77734-93-2-3-2, BRRIdhan 29 X ADT(R) 47 and BRRIdhan 55 X IR 77734-93-2-3-2. Crosses will be done in BRRIdhan 48 X Parija, BRRIdhan 55 X Parija, BRRIdhan 48 X NERICA 2, BRRIdhan 55 X NERICA 2, BRRIdhan 48 X NERICA 4, BRRIdhan 55 X NERICA 4 to obtain short duration high yielding Aus rice.

Production of Somaclone in vitro for Drought Stress Tolerant Plantlet Selection in Potato: An experiment was carried out in plant tissue culture laboratory of the Department of Crop Botany, Bangladesh Agricultural University, Mymensingh to assess the callus induction ability, plantlet regeneration from callus and production of drought stress tolerant somaclones in potato. Diamant and Asterix tubers were allowed to germinate on sand and shoot buds were explanted on MS medium with different PGRs to regenerate plantlets. Subsequently leaf, node and internodes of in vitro grown plantlets were used as explants. The cultures were maintained in a growth room at $25 \pm 2^{\circ}\text{C}$ under light intensity of $35 \mu\text{mm}^{-2}\text{s}^{-1}$ illuminated with florescent tubes. As explant, internode was the best for callus induction as 100 percent explants induced callus. The lowest percent was from leaf explants. Among the plant growth regulators combination of 2, 4-D and NAA at 2.0 mgL^{-1} each was the best for callus induction and also for higher growth of induced callus. Combined effect of 2,4-D and NAA were always better

than single effect of any one. BA affected plantlet regeneration from callus and cent percent explants regenerated plantlet at 5.0 mgL^{-1} of BA. The highest number of shoot (3.0), length of shoot (8.0 cm), number of roots (20) and length of root (3.0 cm) were found at 5.0 mgL^{-1} BA supplemented medium over other treatments. Among the treatments of Kn and IAA, the highest percent (100) explants regenerated plantlets at 2.0 mgL^{-1} each and the lowest 50% was observed at 3.0 mgL^{-1} each. The highest number of shoots per explant, length of shoot, number and length of root were obtained with Kn + IAA at 2.0 mgL^{-1} each supplemented BM. Thus, internode explant on MS medium supplemented with 2,4-D and NAA at 2.0 mg L^{-1} each was the best for callus induction and BA 5.0 mg L^{-1} or Kn + IAA at 2.0 mg L^{-1} each supplemented BM was suitable for callus derived plantlet production in potato. Callus derived plantlets were cultured in PEG supplemented MS medium are expected to produce drought stress tolerant.

An Integrated Approach for the Management of Wilts and Foot Rot/Collar Rot of Important Vegetables: Management of wilts and collar rots in some important vegetables through bio-control approaches was studied. For this purpose, *Trichoderma harzianum* CP (an IPM Lab strain) was formulated in grain brans at 22 different combinations. Lab bio-assay of *T. harzianum* CP against wilts and collar rot pathogens proved the antagonist completely inhibited the growth of *Fusarium oxysporum* pv *melongenae*, *Ralstonia solanacearum* and *Sclerotium rolfsii*. *Trichoderma* produced the maximum of CFU 6.100×10^8 per gram of black gram-peat soil mixture. The second highest CFU $6.090 \times 10^8/\text{g}$ was produced in grass-pea peat soil mixture; third highest CFU 5.800×10^8 was in chickpea-peat soil combination. In the nethouse tray soil experiment, inoculated soil treated with formulated trichoderma @ 20g/kg of soil ensured 82-87% seed germination in tomato, eggplant and Indian Spinach. The treatment reduced pre-emergence death to 13-20% and damping-off to 0.7 – 1.0%. The foot rot was completely checked by the treatment as against 10-13% in the inoculated tray. Soil treatment with formulated trichoderma @ 15g/kg soil yielded better effect than the treatment @ 10g/kg .

Organic amendments for mitigating soil salinity in rice-maize cropping system: The field experiments were carried out at the farmer's field of Botiaghata, Khulna with aman and boro rice and maize crops. Four rice (salt-sensitive; BR-23, BRIS & BRRIdhan 29 and

salt-tolerant, Binadhan-8) and two hybrid maize varieties (BARI hybrid maize-5 and BARI hybrid maize-9) were used as plant materials. Proline was applied as a foliar spray at of 25 mL per plant at seedling and/or vegetative stages. Farmyard manure (FYM) and poultry manure (PM) were added to the soils during final land preparation. The experiments were laid out in a randomized complete block design with three replications. Salinity caused a significant reduction in growth and yield of T. aman and boro rice. BR-23 (aman rice) produced higher yield than other rice varieties under salinity conditions. Local cultivar Mohini produced the lowest yield under salinity conditions. Application of proline significantly increased growth, and grain and straw yields of both aman and boro rice under salinity conditions. Soil amendments with FYM and PM also increased grain and straw yields of rice during aman and boro seasons. No considerable variations in growth and yield of rice due to the different doses of proline and manures. Increased nutrient uptake and K^+/Na^+ ratio in aman and boro rice were observed due to proline application and organic manures. Similar to rice, soil salinity significantly reduced the growth and yield of maize whereas application of proline and organic manures increased the growth and yield of maize under saline condition. Significant increases in nutrient uptake and K^+/Na^+ ratio in maize were observed due to organic amendments with proline and manure.

Biological Nitrification Inhibition is a novel approach for enhancing nitrogen use efficiency in cereal production: The natural ability of plants to release chemical substances from their roots suppresses effect on nitrifier activity and soil nitrification, is termed 'biological nitrification inhibition' (BNI). Different Several sorghum species from home and abroad were surveyed for BNI capacity in roots using hydroponics. Among the tested sorghum varieties, none of the varieties showed detectable BNI capacity except hybrid sorghum from Japan. Several soil incubation studies were conducted to characterize the stability and ability of MHPP in the soil. The results revealed that MHPP is highly stable in the soil even up to 60 days and the significant amount of MHPP was found in the incubated soil. The Physiological studies on the mechanisms of BNI-compounds release revealed that the form of NH_4^+ has the trigger (stimulatory) effect on BNI compound release from sorghum; and NH_4^+ uptake, Plasma membrane H^+ -ATP-ase activity and rhizosphere acidification may be functionally interconnected with BNI release in sorghum. The

further results of the field and pot experiments indicate that the inhibitor (i.e. MHPP) may effectively inhibits nitrification process and improves nitrogen use efficiency by improving growth and yield parameters of rice

Remote controlled GUTI Urea Applicator: The application of *guti* urea requires 25-35% less urea with one round application per crop than that of traditional hand broadcasting method. On the other hand, yield of rice increases by 15-20 % with the use of *guti* urea applicator. However, placement of *guti* urea below the soil surface is a laborious, back breaking work for farmers. Furthermore, farmers have to walk hard across the muddy field many times which make them unwilling to work. With a view to solve the above difficulties and to provide more comfort to farmers, this research project has been initiated to develop a remote controlled *guti* urea applicator that could place *guti* urea efficiently. The necessary component of the devices such as metering unit, the chassis, furrow opener and furrow closer have been designed and fabricated. The battery of required matching power and remote control mechanism have been selected. The first version of the device is now ready for assembling. The work progress is satisfactory and is on planned schedule

Study on Fish Disease and Health Management in Rural Aquaculture: Lack of information exists on fish disease and health management in rural aquaculture. In order to understand fish health problems and to identify and characterize pathogens clinical, bacteriological and histopathological techniques were employed with naturally infected fishes collected from different rural farms. A total twelve bacterial isolates were collected from the sampled fish. Primary identification and characterization of bacterial isolates included Gram's stain, motility test, oxidase test, O-F test, 0/129 and antibiotic sensitivity tests. Further characterizations were accomplished using API-20E microbial identification kit. All the isolates were identified as *Aeromonas hydrophila*. They were mostly recovered from kidney and lesion of affected fishes. Hemorrhagic lesion over body surface especially in mouth and caudal region and rectal protrusion in pangas were associated with the bacterial infection. Internally, kidney, liver and spleen were swollen and enlarged. The pathogenicity of the bacterial isolates has also tested by injecting fish intramuscularly with bacterial suspension. As part of treatment trail, the effects of six antibiotics have been examined with

experimentally infected fish. Variations were found with the effect of the antibiotics on infected fishes. The pathology associated with bacterial infections has also been studied. The aeromonad isolates varied with their pathogenicity but showed similarity in antibiotic sensitivity. Future studies focus on further isolation and characterization of pathogens and treatment trial with selected drugs in field condition to find out effective disease treatment and fish health management packages.

Study of reproductive endocrinology of mud eel *Monopterus albus* for artificial propagation: In order to understand different aspects of reproductive biology of endangered mud eel *Monopterus albus* gonado-somatic index (GSI), gonadal maturity stages, fecundity, ova diameter and secondary sexual characters were studied for a period for one year. Fish samples were collected from *haor* and *beel* areas of Mymensingh and Netrokona districts. The highest GSI of $6.002 \pm 1.672\%$ was observed in mid May and lowest of $0.232 \pm 0.015\%$ in September. This indicated that the peak breeding season of mud eel was from late April to early May. Monthly observation of ovarian gametogenesis utilizing routine haematoxyline-eosin protocol identified presence of undeveloped oocyte (UO), oogonium (O), early perinucleolar oocyte (EPNO), late perinucleolar oocyte (LPNO), previtellogenic oocyte (PVO), yolk vesicle (YV), yolk granule (YG), premature (PM) and mature (M) stages of oocytes in ovary samples from different seasons. In this study, the mature stages of oocytes (PM and M oocytes) were found from April to June samples of ovary, indicating the spawning season of *M. albus*. The ovaries contained developing oocytes (UO, EPNO, and LPNO) from July to February, indicating spent and resting phases of ovary during these months. Fecundity was measured for a period from mid March to mid May and ranged between 132 (body weight 240g) to 461 (body weight 380g). The highest fecundity was observed in mid April and the lowest was in mid May. Ova diameter was estimated during the breeding season which ranged between 3.1 to 3.9 mm. Ova diameter was highest in mid May and lowest in mid April. The most distinct feature to separate the both sexes was shape of their genital papilla. The female papilla became rounded and swollen; on the other hand the male genital papilla was sunken and elongated, observed in April-May. This study provides the first detailed information about oogenesis of *M. albus* from the Sylhet basin of Bangladesh. It is expected that the information of this study can potentially be used for

bringing a new high priced fish into aquaculture for supporting export earnings of the country in future.

Production of genetically male tilapia by identification of YY supermales using microsatellite DNA markers: Monosex (male) Nile tilapia *Oreochromis niloticus* is highly preferable for commercial production system to control unwanted reproduction by females and to obtain higher growth of even sized male tilapia leading to good profit. The technique of producing all male using androgen hormones (particularly 17- α -methyl-testosterone) is being widely used in Bangladesh. However, the use of hormone in the direct food chain is prohibited in many countries of the world because of the adverse physiological effects. Already sex-linked markers have been identified for Nile tilapia which can assist selection of YY males in tilapia. The study aims at the production of genetically male Nile tilapia using such markers. The production of YY males in conventional way and identification of those super males by the sex-linked markers is the target of the present study. Hormonal sex reversal of mixed sex has been performed to obtain XY neofemales. The acetocarmine gonad squashing method can be employed to detect the percentage of sex-reversal rate to continue breeding between XY neofemales and XY normal males to get 25% YY progeny.

Development of breeding and fry rearing techniques of endangered Tengra, *Mystus vittatus* and Gulsha, *Mystus cavasius*: Experiments were conducted to develop breeding and fry rearing techniques of two threatened catfish, *tengra*, *Mystus vittatus* and *gulsha*, *Mystus cavasius*. The live fish was collected from natural water bodies and stocked in ponds in the Faculty of Fisheries, Bangladesh Agricultural University campus and reared with farm made and commercial supplemental feeds. Both the fish species were successfully domesticated in captive condition and growth and breeding related parameters such as GSI, fecundity etc. were studied. The fecundity of *tengra* was ranged from 8346 to 42253 in May and 9073 to 22705 in June. Similarly, the fecundity of *gulsha* was ranged from 4752 to 7776 in May and from 7413 to 16331 in June. Partial GSI study revealed that both the species breeds in monsoon season i.e. starts from April and breeding season can be extended for next few months. Six month GSI values revealed that April is the pick time for *tengra* and June for *gulsha* for breeding. Artificial breeding trials were conducted using carpPG extract with three different dosages (2 &

6, 4 & 8, 6 & 10 mg/kg b.wt. for male and female respectively) and 2 & 6 mg/kg b.wt. of carpPG extract produced best results. In case of tengra, about 62-85% fertilization and 55-70% hatching were obtained while 64-80% and 57-71% fertilization and hatching were recorded from gulsha respectively. Hatchlings of tengra and gulsha are being reared in aquarium and tray with supplemental feed such as hard boiled egg-yolk, tubifex, and plankton and their rearing techniques were developed.

Increasing nitrogen use efficiency through nitrogen and water management in the rice-rice cropping pattern:

The project was undertaken at Soil Science Field Laboratory, BAU, Mymensingh with management practices like water and fertilizer along with nitrogen efficient variety selection to increase nitrogen use efficiency of rice-rice cropping pattern. Three interlinked experiments were conducted to achieve the goal viz. N fertilizer trial, fertilizer in combination with water trial, variety selection trail. The fertilizer experiment consisted of 7 treatment combinations of different forms of urea fertilizer (Prilled urea (PU), and USG 1.8g & USG 2.7g) and cowdung. Split application of PU instantly increased porewater $\text{NH}_4\text{-N}$ and $\text{NO}_3\text{-N}$ and came down to ground state after 6 days of application during the all three splits of PU. USG application specially 78 kg N ha from USG (1 x 2.7 g/4 hills) generated available $\text{NH}_4\text{-N}$ and $\text{NO}_3\text{-N}$ slowly rather spontaneously over a long time indicating a beneficial role of USG over PU. The application of USG alone or in combination with organic manure performed significantly better in terms of yield and yield parameters compared to 100% dose of PU. The fertilizer and water management experiment was laid out in split plot design using water in the main plot and fertilizer N in the subplot. The two water regimes, AWD and CF used in the experiment did not show marked variation in growth and yield of rice. The water management had some problem due to three dimensional movement of water, we failed to manage water as we expected in the first crop and we have already sorted how to overcome the limitations. Like the fertilizer experiment the USG alone or in combination with cowdung gave better yield. The variety experiment was conducted using fifteen boro cultivar taking 3 local varieties and 12 high yielding varieties. The highest grain yield of 5.75 t/ha was recorded in BRRI dhan 29.

Sher-e-Bangla Agricultural University

Influence of fertilizer, manure and water management on soil fertility, nutrient availability and productivity under Rice-Rice cropping system:

The experiments were conducted at in the farm of Sher-e-Bangla Agricultural University farm, Dhaka, Bangladesh during July 2013 to June 2014 to study the effect of different organic manure and inorganic fertilizer with unusual water management on the growth, yield of rice and nutrient availability in paddy soil over rice growing periods. BRRI dhan 32 and BRRI dhan 29 were used as the test variety for boro and T. Aman season. The two rice-rice cropping experiments are being conducted in the same 48(8 fertilizer x 2 irrigation x 3 rep.) and 72(8 fertilizer x 3 irrigation x 3 rep.) plots. The yield parameters, yields and nutrient concentrations of grain, straw were significantly affected by fertilizer and manure. The yield and yield parameters were not significantly influenced by different irrigation treatments. In the second crop T. Aman rice and 3rd crop boro rice, the higher grain and straw yields were found in T₇ (70% NPKSZn + 2.1 ton poultry manure/ha) treatment in both experiments and the interaction effects of fertilizer and irrigation were not significantly influenced the yield and yield parameters. The pore-water nutrient availability was also affected by fertilizer and irrigation treatments. The higher grain yield and grain N, P, K and S concentrations were found in the fertilizer treatments where the pore-water nutrient concentrations were higher.

Sylhet Agricultural University

Development of artificial breeding techniques of *Sperata aor*:

Bangladesh is blessed with a rich fish biodiversity and is ranked third in inland fisheries in Asia after China and India with approximately 300 fresh and brackish water fish species (Hussain and Mazid, 2001). Once upon a time, the country was enriched in various indigenous fish species. But now these species are declining day by day due to various anthropogenic reasons. Ayre (*Sperata aor*) commonly named as long-whiskered catfish is one of the important bagrid catfish. It has been considered as one of the most admired edible fish among indigenous catfish species due to good taste and high nutritive value. This fish species has a very good market demand. But unfortunately natural stocks of this species have drastically reduced and become threatened due to overfishing, habitat degradation, aquatic

pollution, and several other anthropological reasons. Presently, *S. aor* is regarded as vulnerable (IUCN-Bangladesh 2000) fish species. In order to maintain this fish population as well as to conserve their biodiversity in nature immediate measures should be taken. So, the overall goal of this project was to carry out a detailed and in-depth scientific study in order to establish artificial breeding techniques of *S. aor*. To achieve this goal it is necessary to understand the breeding biology of this species, assess their reproductive potential in captive condition as prerequisites. A number of brood fish were collected and reared in the research ponds both on station (Research ponds in the Sylhet Agricultural University campus) and on farm (American fish farm Ltd. at Zakigonj) for nine months periods. Their growth performances were measured on month basis. To examine the monthly changes in the gonads for estimating spawning season, the GSI was calculated by: $GSI = (\text{Weight of gonads/weight of fish}) \times 100$. The average length and weight of the *S. aor* fry became 27 cm and 148 gm, respectively on station in April. While on the farm it became 39 cm and 700 g, respectively. On the other hand, average length and weight of the brood became 34 cm and 500 g, respectively on station. While on the farm it was 45 cm and 1000 gm, respectively. The brood fishes reared in on station ponds did not perform natural breeding yet. But on the other hand, natural breeding of *S.aor* was observed in on farm in captivity. The GSI of female was found to be decreasing from October to February and lowest was recorded on December. It was found to be increasing from February to May. On the other hand, the lowest GSI (Gonado-somatic Index) value of male was found in November and after that it was gradually increasing and the highest was observed in May.

Adaptation of heat tolerant tomato and photo insensitive country bean variety during summer season in Sylhet region: This project was undertaken with a view to adapt of heat tolerant tomato hybrids and photo insensitive country bean variety and their production technologies during summer season in

Sylhet region. Four heat tolerant tomato hybrids and four photo insensitive country bean lines were included in this study from the study 150g hybrid seed of BARI Hybrid tomato-4 and 850 g seeds of one photo-insensitive country bean line were produced during winter season of 2012-13 for further evaluation and demonstration in the farmer's field. Seeds of other varieties were collected from BARI for evaluation under Sylhet condition. One trainers training comprising DAE, BADC and NGO personnel and two farmers training comprising 20 farmers each were organized on summer tomato and summer bean production technology during April/May 2013. Summer tomato and summer country bean seeds and other logistic support were given to 30 farmers of Sylhet and Moulavibazar districts for field demonstration. On station evaluation of 4 photo-insensitive country bean lines and 4 heat tolerant tomato hybrids were started from the month of April and May 2012, respectively in the experimental field of Sylhet Agricultural University. These evaluations are going on. Fruit bearing status of tomato and country bean lines are very encouraging both in on station and on farm demonstration. Harvesting of ripe fruit of tomato and green pod of country bean is going on in regular interval and necessary information regarding yield and yield attributes are collecting properly for interpretation of the results.

A. Monitoring of Programmes/Activities

Nine teams were formed with the scientists of BARC for field monitoring of the research/technologies transfer programs carried out during the period of 2013-14. The teams were assigned to visit and monitor the BARC funded research/technologies transfer programmes implemented by different NARS and associate institutes. The following table presents the team composition, monitoring regions, organization visited:

Team composition for Field Monitoring of Research activities under Research Grant Fund of BARC (2013-14)

Team No.	Locations	Institutes Involved	Project-No.	Team Composition
1.	Gazipur	BARI (Gaz.)	1,2,4,8,9	Dr. Md. Khairul Bashar, MD (Livestock) - Team Leader Dr. Md. Aziz Zilani Choudhury, CSO (Crops)-Member

				Dr. Nazmun Nahar Karim, PSO (Agril.Eng.)-Member
2.	Gazipur Dhaka	BARI (Gaz.), BSMRAU (Gaz.), SAU (Dha.)	26,27,32, 36, 37	Dr. Abul Kalam Azad, CSO (Crops)- Team Leader Dr. Monirul Islam, Director (Nutrition)-Member Mr. Md. Mosharraf Uddin Molla, PSO (AERS)-Member
3.	Sylhet	Syl -AU(Syl) Syl -AU (Zakigonj)	30,31	Mr. Md. Abeed Hossain Chowdhury, Director (Computer)-Team Leader Dr. Mian Sayeed Hassan, PSO (Crops)-Member Dr. Md. Abdul Awal, PSO (P&E)-Member
4.	Jamalpur Sherpur Mymensingh	BARI (Jam. Sher.), BINA (Mym), BAU(Mym)	3,12,14,15,16,18, 19	Dr. A.S.M Anwarul Huq, CSO (AERS)- Team Leader Dr. S.M. Bokhtiar, PSO (Soils)-Member Mr. Md. Abdul Mottakin, DD (Budget)- Member
5.	Mymensingh	BAU (Mymensingh)	20,21,22, 23,24,25, 33	Dr. Md. Shamsher Ali, CSO(P&E)-Team Leader Dr. Fauzia Yasmin, PSO (TTMU)-Member Mr. Ajit Kumar Chakrabarty, DD(Accounts)-Member
6.	Faridpur Rajbari Magura Khulna	BAU (Khul.), BARI (Far., Raj.) SRDI (Far.) BINA (Magu.)	6,12,17, 28	Dr. Kabir Ikramul Haque, MD (Fisheries)- Team Leader Dr. Mohammed Shahjahan, CSO (Forestry)-Member Mr. Md. Aminuzzaman, Director (M&T) – Member
7.	Bogra Rajshahi,	BARI (Raj.), BINA (Raj.)	1,7,13	Dr. S. M. Khalilur Rahman, MD (AERS) -Team Leader Dr. S. M Khorshed Alam, PSO (Crops)-Member Mr. Md. Mustafizur Rahman, PTO- Member
8.	Burirhat Rangpur Dinajpur	BARI (Buri.), BINA (Rang.), HDSTU(Dinaj.)	1,12,34	Dr. Paresh Chandra Golder, MD(P&E) -Team Leader Dr. Shah Md. Ziqrul Haque Chowdhury, CSO(Livestock)-Member Mr. Rafiq Mustofa Kamal, PDO- Member
9.	Barisal, Patuakhali Bhola	BARI (Bar.), BJRI (Pat.), BINA (Bar, Bho.)	5,13,14, 15	Dr. Sultan Ahmed, CSO (Agril.Eng.)-Team Leader Ms. Dil Afroz, Director (AIC)- Member Md. Mahbubul Hassan, Senior AD (Admin.)-Member

Field Monitoring Report of (2013-2014) Research Grant of BARC

Monitoring Report of Team-1

The team 1 consists of Md. Khairul Bashar, Member Director (A&F), BARC (Team Leader)), Dr. Md. Aziz Zilani Chowdhury, CSO (Crops), BARC (Member) and

Dr. Nazmun Nahar Karim, PSO (Agril. Engg), BARC (Member) visited Bangladesh Agricultural Research Institutes (BARI), Gazipur on 05 February 2014. A total of five research projects were monitored by the teams which are listed below:

Sl.	Title of the project visited	Organization
1	Improvement of gladiolus quality and its adaptation PI: Dr. Kabita Anzu-Man-Ara, PSO, Floriculture Division, HRC, BARI, Gazipur-1701	BARI
2	Development of technology for production of seedless fruits of guava and lemon (<i>Mini Elachi Lebu</i>) in off season PI: Dr. Md. Al-Amin Hossain Talukder, SSO (Pomology), HRC, BARI, Gazipur	BARI
3	Integrated management of banana diseases caused by fungi and nematode PI: Dr. Md. Abdur Rahman, CSO and Head Plant Pathology Division, BARI, Gazipur 1701	BARI
4	Development of packages for fruits (mango, banana) and vegetables (yard long bean, pointed gourd, okra) PI: Mr. Mohammad Mizanur Rahman, Scientific Officer, Postharvest Technology Division, BARI	BARI
5	Study on rural household's food security in coastal region of Bangladesh PI: Mr. Moniruzzaman, SSO, AE, Division, BARI, Gazipur	BARI

Visit – 1: 05 February 2014

Improvement of gladiolus quality and its adaptation

- Objective (s): (i) To improve flower & corm quality, (ii) To disseminate gladiolus varieties, (iii) To increase yield and farmers income
- Implementing Agency: Floriculture Division, HRC, BARI, Gazipur-1701.
- Name of the PI: Dr. Kabita Anzu-Man-Ara, PSO (Floriculture), HRC, BARI.
- Locations: HRC, Joydebpur, Jannabazar (Sreepur), Godkhali (Jessore), Sonatola (Bogra) and Najirhat, Burirhat (Rangpur).

5. Major Activities

Sl. no.	Planned Activities	Implementation Status
1	Land preparation	The experimental land was well prepared
2	Materials and input collection	Necessary steps for procurement were taken for making availability of materials and input in time
3	Setting up experiment	Location: HRC, BARI, Gazipur. Design: RCB Design, Rep: 3, Plot size: 2.0 × 1.5 m. Treat: 8, T ₁ - BARI Gladiolus-1(ch) and 7 genotypes (T ₂ -GL002, T ₃ -GL004, T ₄ - GL010, T ₅ -GL012, T ₆ -GL029, T ₇ -GL031 and T ₈ -GL037) collected from different places of Jessore district D/Plantation: 20 th November, 2013
4	Intercultural operation	Weeding, mulching, earthing up, disease and insect-pest management, watering etc. were done as required.

5	Data collection	Data were collected at different stages of gladiolus. Fifteen plants from each of the plots were recorded for recording data for plant height, number of leaves, days to spike initiation, spike length, rachis length, number of floret, weight of single spike, spike number, vase life, days to flowering etc.
6	Results (2012-13)	GL-012, GL-029, GL-031 and GL-037 found as promising genotypes for flower and corm characters such as attractive colour, early flowering, maximum number of florets, longest spikes and rachis, highest weight of spike, longest vase life, flowering duration as well as corm and cormel production etc.

6. Major Observation by the Monitoring Team: i) Out of 8 genotypes studied, T-6 (GL029) was found higher yield than the check variety BARI Gladiolus-1 in 2012-13, ii) The same trend also observed because the genotype T-6 (GL029) produced 2-4 stalk/corm in all the replications. The genotype T-5 (GL 012) was found earlier (50% flowering completed) compared to other studied material; iii) The experiment was found well managed.

7. Budgetary Information: i) Approved Budget (2013-14): Tk. 2,80,000/-; ii) Fund released (to date): Tk. 1,40,000/-; iii) Fund spent (to date): Tk. 1,14,924/-

8. Constraints: Fund is not sufficient for conducting training, field day and demonstrations.

9. Suggestions:

- Information on crossing needs to be provided in the final report.
- The steps followed for the improvement of Gladiolus needs to be included in the report.
- Total number of plants of each genotype from each replication should be counted after germination and at the time of harvest for accuracy of the result.
- In signboard the name of the genotypes could be given to make itself explanatory and for better understanding of the visitors.
- Funding source needs to be mentioned in signboard.



The team visited the experimental field of improvement of gladiolus quality and its adaptation and consulted with Dr. Kabita Anzu-Man-Ara, PSO, Floriculture Division, HRC, BARI, Gazipur

Visit-2, Date: 05 February 2014

Development of technology for production of seedless fruits of guava and lemon (Mini Elachi Lebu) in off season

1. Objective (s): i) To determine the effect of different concentration of GA₃ on floral buds of guava and lemon, and on fruit quality and yield; ii) Evaluate the effect of time of GA₃ application on floral buds of guava and lemon on fruit quality and yield.

2. Implementing Agency: HRC, BARI, Gazipur-1701.

3. Name of PI: Dr. Md. Al-Amin Hossain Talukder, SSO (Pomology), HRC, BARI, Gazipur-1701.

4. Locations: a. HRC, BARI, Gazipur b. RARS, Akbarpur, Moulvibazar

Experiment: Effect of GA₃ on Mini Elachi Lebu to induce seedless fruit

5. Major Activities:

Sl. no.	Planned Activities	Implementation Status
i	Procurement of research inputs	Necessary inputs were collected timely
ii	Experiment establishment	Saplings were planted in the Fruit Research Farm, HRC, BARI, Gazipur on May 2012. GA ₃ @ 0, 50, 100, 200, 300 and 400 ppm were applied as per treatment on August 2013
iii	Management	Irrigation, weeding and fertilizer were applied timely. Plant protection measures especially leaf miner was controlled effectively by applying furadan in the soil (in ring method).
iv	Data collection	Fruits are in developing stage.

Experiment: Effect of GA₃ on Guava to induce seedless fruit

5. Major activities

Sl. no.	Planned Activities	Implementation Status
i	Procurement of research inputs	Necessary inputs were collected timely
ii	Experiment establishment	Higher concentrations of GA ₃ (0, 300, 400, 500 and 750 ppm) were applied on flower bud on October 2012.
iii	Management	Irrigation, weeding and fertilizer were applied timely. Plant protection measures were done timely.
iv	Data collection	Fruits are in developing stage.

6. Major Observation by the Monitoring Team: Seedless lemon was observed from the application of GA₃ (300 ppm) at budding stage just before flowering (in second flash). The similar type of experiment for guava was also observed. Higher dose (application of GA₃; 400, 500, 600 and 750 ppm) selected for spraying of GA₃. Because last year the result was not satisfactory towards producing seedless guava through application of GA₃ at 50, 150, 200 and 250 ppm. Normally GA₃ applied as spray in the month of April/May during flowering stage. The experimental field was good. But growth of the plants of Elachi Lebu was different.

7. Budgetary Information: i) Approved Budget (2013-14): Tk. 3,30,000/-; ii) Fund released (to date): Tk. 1,65,000/-; iii) Fund spent (to date) Tk. 1,35,375/-

8. Constraints: Duration of the project not sufficient enough to draw a tangible recommendation.

Suggestion: Precautionary measures should be taken while spraying different doses of GA₃ (0, 50, 100, 150, 200, 250 & 300 ppm) in the same plant (for getting effectiveness of GA₃). For correct interpretation of the result, number of seeds of elachi lebu should be counted which was observed in different treatment of GA₃.

Chemical analysis should be done to know the accuracy behind seedless or less number of seeds in lemon.

Result: Effect of GA₃ application at One week after bud break for parthenocarpic mini elachi lebu induction

GA ₃ con. (ppm)	Fruit size		Fruit wt. (g)	Number of seeds/ fruit
	Length (cm)	Breadth (cm)		
0	7.1	5.1	86.0	41.7
50	6.5	5.5	87.5	36.8
100	6.6	5.2	82.7	37.0
200	6.4	5.5	85.5	26.4
300	5.7	4.6	63.4	0.6



The team visited the experimental field of guava and consulted with Dr. Madan Gopal Saha, CSO, BARI and Md. Al-Amin Hoassin Talukder, SSO, BARI

Visit – 3, Date: 05 February 2014

Integrated Management of Banana Diseases caused by Fungi and Nematode

1. Objective (s): i) To identify the disease incidence and damage for panama in major banana growing areas in the country; ii) To isolate, purify and preservation of the panama causing fungus; iii) To find out the effective control measure against panama disease in Lab and pot; iv) To adopt the most effective control measure for panama, sigatoka and nematode in farmer's orchard; v) To develop a IPM package technology for banana production
2. Implementing Agency: Plant Pathology Division, BARI, Gazipur.
3. Name of the Principal Investigator: Dr. Md. Abdur Rahman, CSO and Head, Plant Pathology Division, BARI, Gazipur.
4. Implementation Locations: Survey (Jessore, Tangail, Rangpur, Bogra and Narsingdhi).

5. Experiment: Gazipur (Pot and Field)

Sl. no.	Planned Activities	Implementation Status
i	Conducting survey	Completed in 6 upazila: Gabtoli & Sadar (Bogra), Monohardi (Narsingdi), Kapasia (Gazipur), Trisal (Mymensingh), Kaliganj (Jessore)
ii	Isolation and identification of pathogen	25 isolated of the panama-pathogen are maintained
iii	Pot experiment on panama and nematode	Completed
iv	Field expt to integrate the control measures for panama and sigatoka	Experiment was in the field at BARI, Gazipur

6. Major Observation by the Monitoring Team: No disease incidence was observed in banana plant. It was informed by the PI, that disease may appear in rainy season (June/July) and when temperature rises.

7. Budgetary Information: i) Total Approved Budget (3 years): Tk. 8,00,000/- ii) Fund released: Tk. 6,50,000/-; iii) Fund spent (to date): Tk. 6,34,215/-.

8. Constraints: Conducting experiment at farmer's field is costly.

Suggestion: As per project plan one training/field day needs to be conducted as earliest possible time.

Name of both the banana varieties (Sagar and Sabri) should be mentioned in signboard.

9. Any Other Information: New symptom (transverse cracking) of panama disease identified last year from Narsingdi district in *Sabri kala*.



The team visited the experiment field integrated management of banana diseases caused by fungi and nematode and consulted with Principal Investigator Dr. Md. Abdur Rahman, CSO and Head Plant Pathology Division, BARI, Gazipur

Visit- 4, Date: 11 February 2014

Development of packages for fruits (mango, banana) and vegetables (yard long bean, pointed gourd, okra)

1. Objective (s): i) To standardize the packages of selected fruits (mango, banana) and vegetables (yardlong bean, pointed gourd, okra) at farmers, traders and retailers level and ii) Quality evaluation of fruits and vegetables in the packages
2. Implementing Agency: BARI, Postharvest Technology Division
3. Name of the PI: Mr. Mohammad Mizanur Rahman, Scientific Officer, PHT Division, BARI
4. Implementation Locations: Postharvest Technology Division, BARI, Gazipur.

5. Major Activities:

Sl. no.	Planned Activities	Implementation Status
i	Input collection	Different types of wooden box and corrugated fiber box (CFB) carton have been design and some packets also developed for the study. Two types of plastic crates (nested and non-nested/normal crates) have been collected from the local producers. Some cushioning materials like foam net, plastic film and low density polyethylene (LDPE, 33 micron) and high density polyethylene (HDPE, 34 micron) packets and laboratory consumables have been collected from local markets.
ii	Collection of fresh fruits and vegetables	Matured mango had collected from Shibganj, Chapai Nawabgonj.
iii	Experiment Conducted	One experiment conducted on mango for evaluating packages and packaging materials, and also the keeping quality of the fruits inside the packages.
iv	Material: Matured mango (Fazli variety) Treatments: Control (Traditional basket) Plastic crates + 2% perforated PP Plastic crates + 3% perforated PP Plastic crates + 4% perforated PP CFB cartoon + 2% perforated PP CFB cartoon + 3% perforated PP CFB cartoon + 4% perforated PP Wooden box + 2% perforated PP Wooden box + 3% perforated PP Wooden box + 4% perforated PP Replication: 03, Design: CRD	

	Data recorded: Color, firmness, vitamin A & C, percentage decay, shelf life, etc.	
v	Experimental data recording, compilation & analysis	Experimental data on color, firmness, production of gases inside the packets and shelf life and physicochemical parameters for mango of variety 'Fazli' have been recorded. The recorded data will be analyzed and compiled later

6. Major Observation by the Monitoring Team:

- The experiment conducted through systematic approach and design.
- Different standardize packages/boxes made of wood, plastic and board materials for fruits (mango, banana) and vegetables (yard long bean, pointed gourd, okra) were found in the laboratory.
- Arrangement of nutritional analysis of fruits and vegetables were found in the laboratory.
- Wooden box: 62 × 36 × 35.5 cm (capacity 20-25 kg): suitable for fruit transportation.
- Wooden box: 54.5 × 40 × 32 cm (capacity 20-25 kg): suitable for vegetable transportation.
- Plastic crates: 61 × 42 × 30 cm: suitable for fruit & vegetable transportation.

7. Budgetary Information: i) Approved budget (2013-14): Tk. 3,91,000/-; ii) Fund released: Tk. 1,95,500/-; iii) Fund spent: Tk.1,05,899/-.

8. Suggestions: Experimental findings need to be disseminated to the farmers and retailer/traders through training and distribution of leaflet/booklet.

9. Any Other Information: Matured green banana in 1% perforated polypropylene packet and then transporting in corrugated fiber box (CFB) carton delayed the ripening process and prolonged storage life upto 20 days at 20±2° C and 75-85 RH. Okra pre-treated with chloric water and then packaging in 0.4% perforated polypropylene and transportation in plastic crates/wooden crates/CFB carton is best for quality and shelf life for 10 days. Pointed gourd pre-treated with chlorine (200 ppm chlorox/halotab) water and then transportation in wooden or plastic crates (packaging and storing in 10.2% perforated polypropylene packets) resulted substantial reduction in losses due to physiological weight loss, rotting/shriveling and retained considerable marketable quality. Its shelf life extended up to 10 days compared to non-treated and without packaging.



The team visited the experiment field and consulted with Principal Investigator Mr. Mohammad Mizanur Rahman, Scientific Officer, PHT Division, BARI

Visit –5, Date: 11 February 2014

Study on rural household's food security in coastal region of Bangladesh

1. Objective (s): i) To investigate the rural household's access to food in terms of food production, household income, asset ownership, and income diversification of farm and non-farm households, ii) To estimate the existing rural household's food status in the coastal region, iii) To explore the coping strategies of coastal people during stress situation, and iv) To suggest some policy guidelines for enhancing coastal peoples living status.

2. Implementing Agency: Agricultural Economics Division, BARI, Gazipur.

3. Name of the PI: Mr. Moniruzzaman, SSO (Agricultural Econ), BARI, Gazipur.

4. Locations: 03 District: Noakhali, Laxmipur & Cox's Bazar.

5. Major Activities:

Sl. no.	Planned Activities	Implementation Status
i	Survey areas and sample household selection	The study areas namely Noakhali, Laxmipur and Cox's Bazar were selected through Agricultural Extension Office (DAE). Total sample size was 450. A complete list of respondent farmers was collected through DAE.
ii	Pre-testing & finalize questionnaire	Questionnaire pre-testing and its finalized.
iii	Field survey and data collection	Data collection was completed in Noakhali and Laxmipur districts with the help of DAE personnel, using random sampling technique. The rest of data will be collected from Cox's Bazar district during February, 2014. *150 farmers/district (50 farmers x 3 upazila)
iv	Data processing and analysis	Data entry in computer excel sheet is going on. (Data analysis by April, 2014).
v	Compilation	Draft report to be prepared by May, 2014.
vi	Final report	Final reporting in June, 2014

6. Major Observation by the Monitoring Team: The activities are going on as per plan. All arrangements were completed for surveying in Cox's Bazar.

7. Budgetary Information: i) Allocated budget (2013-14): Tk. 2,55,000/-; ii) Fund released: Tk. 1,27,500/- iii) Fund spent: Tk. 1,05,112/-

8. Constraints: Fund is not sufficient to conduct such type of experiment (preliminary survey) and also timely release of fund is needed. Suggestions: Need to provide survey results for individual district in the final report.

9. Any other information: According to PI of the project, 55% of the household are food secured while 45% are not fully food secured. Two to three times visit is required for each district to cover each upazila, so that primary data collection would be more productive.

Monitoring Report of Team-2

The team members were Dr. Abul Kalam Azad, CSO (Crops)- Team leader, Dr. Monirul Islam, Director (Nutrition)- Member and Dr. Md. Mosharraf Uddin Molla (AERS)- Member. The monitoring team monitored the implementation progress of four out of five core research projects at Sher-e-Bangla Agricultural University Farm, Sher-e-Bangla Nagar, Dhaka, BARI Joydebpur, Gazipur and BSMRAU on 3 March and 20 March 2014. The following projects were monitored by the team. Two members of the team monitored the Projects.

Total Research Activities Monitored (2013-14): 04 out of 05



The team member investigated the study report on rural household's food security in coastal region of Bangladesh" and consulted with Mr. Moniruzzaman SSO (Agricultural Econ), BARI, Gazipur.

Title of the Project	Institutes Involved
1. Influence of fertilizer, manure and water management on soil fertility, nutrient availability and productivity under Rice-Rice cropping system	SAU, Dhaka
2. Evaluation of New Plant Type (NPT) advanced lines of rice for Aman season as high yielding varieties	SAU, Dhaka
3. Development of Gynodioecious Papaya Variety	BARI, Gazipur

4. Integration of fish culture with hydroponic agriculture system for alternate rural livelihoods	BSMRAU, Gazipur
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5. Export and Import Analysis of Selected Vegetables and Spices in Bangladesh	BARI, Gazipur
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Influence of fertilizer, manure and water management on soil fertility, nutrient availability and productivity under Rice-Rice cropping system

1. Objectives: i) To know the fate of fertilizer, manure and nutrient availability in rice soil with different water management practices, and ii) To evaluate the effects of fertilizer, manure and irrigation on the yield of rice.
2. Implementing Agency & Division: Dept. of Soil Science, Sher-e-Bangla Agricultural University, Dhaka.

3. Name of the Principal Investigator: Professor Dr. Md. Asaduzzaman khan, Department of Soil Science, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka-1207.

4. Implementation Location: SAU Farm, SAU, Sher-e-Banglanagar, Dhaka-1207

5. a) Major Activities:

Planned Activities	Implementation Status (March 2014)
Fate of organic and inorganic fertilizer in paddy soil with different water management under rice-rice cropping system	The researcher started the experiment from 2011 at SAU farm, Dhaka. The first crop, boro rice (BRRI dhan 29) was grown in 48 plots during December 2011 to May 2012.
	Then second crop T. Aman rice (BRRI dhan 33) was grown in the same plots during July-October 2012.
	Then, the same 48 plots were prepared for 3 rd crop boro rice cultivation.
	Then the 4 th crop T. Aman rice (BRRI dhan 33) was grown in the same plots during July 2013 to October 2013.

Results: The brief results of 4th crop (T. Aman) and present 5th crop (Boro rice) cultivated during 2013-2014. The researcher found that yield and yield parameters were significantly influenced by irrigation and fertilizer. Higher grain and straw yields were obtained by using fertilizer plus manure. The highest grain yield (5.04 t/ha) of T. Aman rice was obtained from T₇ (70% inorganic fertilizer and 2.1 t/ha poultry manure) treatment which was statistically similar to T₄ (50% NPKS+ 5 ton compost per ha) and T₆ (50% NPKS + 3.5 ton poultry manure per ha) treatments where fertilizer and manure were used.

Results: The brief results of 4th crop (T. Aman) and present 5th crop (Boro rice) cultivated during 2013-2014 pre-water samples were collected during 4th crop T. Aman growing period. The pore-water nutrient concentrations were significantly influenced by fertilizer treatment. Pore-water samples of 5th crop (boro rice) with different dates were collected and analyzed for N, P, K & S. The N, P, K & S concentrations were significantly influenced by fertilizer and irrigation treatments.

5 (b) Major Activities:

Planned Activities	Implementation Status (March 2014)
Integrated use of fertilizer and manure with different water management on rice yield, soil fertility and nutrient availability under Rice-Rice cropping system	The researcher started this experiment at SAU farm from December 2011. The treatment-wise fertilizers and irrigation were applied during boro rice growing period and recommended doses of chemical fertilizer were applied in the same plots during T. Aman season.

	The 1st crop boro rice (BRRI dhan 29) was grown properly in 72 plots.
	Then 2nd crop T. Aman rice (BRRI dhan32) was grown in the same plots during July – October, 2012 for knowing the residual effects of added fertilizer and manure in the previous boro crop.
Fate of organic and inorganic fertilizer in paddy soil with different water management under rice-rice cropping system	The 3rd crop (2nd boro) boro rice was harvested on 20th May 2013.
	The 4th crop T. Aman was transplanted in the same 72 plots during last week of July 2013 to October 2013.
	The same experimental plots were prepared for 5th crop (3rd boro rice) cultivation. Treatment wise fertilizer and manure were applied in the same 72 plots for 5th crop transplantation. The seedlings of BRRI dhan 29 was transplanted on 1st January 2014.

Results: The yield and yield parameters of T. Aman (4th crop) rice were significantly influenced by fertilizer and irrigation treatments. The highest grain yield (4.48 t/ha) was obtained from T2 (50% NPKS+5 ton cow dung per ha) treatment and lowest in control treatment.

Results:	The interaction effect of fertilizer and irrigation significantly influenced the grain yield. The highest grain yield 5.35 t/ha was obtained from I2T2 (always saturated condition and 50% inorganic fertilizer plus 5 ton cowdung/ha) treatment combination.
	The fertilizer treatment significantly influenced the straw yield and highest straw yield (6.26 t/ha) was found from T5 treatment where 70% inorganic fertilizer plus 3 ton compost/ha was used.
	The combined application of irrigation and fertilizer significantly influenced the straw yield of T. Aman rice. The highest straw yield (7.2 t/ha) was obtained from I1T5 treatment combination where 70% inorganic fertilizer plus 3 ton compost/ha and continuous flooded condition were applied.

6. Major Observation by the Monitoring Team: The overall project activities have been conducted according to the plan of action to achieve the goal of the project. The team observed two experiments at field level, which were found satisfactory.

7. Budgetary Information: i) Total Approved Budget: TK. 4,00,000/-; ii) Fund released: TK. 2,00,000/-; iii) Fund spent: TK. 2,00,000/-

8. Constraints & Suggestions: To continue the research successfully, it is necessary to release fund in time.



Dr. Abul Kalam Azad, CSO (Crops), Team leader and Dr. Md. Mosharraf Uddin Molla (AERS)–Member visited the experimental field of Sher-e-Bangla Agricultural University

Evaluation of New Plant Type (NPT) advanced lines of rice for Aman season as high yielding varieties

1. Objectives: i. Evaluation of NPT advanced lines for released as variety(s); and ii. Maintain of restorers and maintainers from NPT lines for development of inter sub-specific hybrids (super rice).

2. Implementing Agency & Division: Genetics and Plant Breeding Division, Sher-e-Bangla Agricultural University

3. Name of the Principal Investigator: Professor Dr. Md. Sarowar Hossain, Dept. of Genetics and Plant Breeding, Sher-e-Bangla Agricultural University

4. Implementation location: i. Regional Yield Trial (Aman season, 2013), BRRI Research Farm (Rajshahi, Rangpur, Kushtia and Comilla) and SAU, Dhaka, ii. Seed multiplication (Boro season 2013-2014) Research Farm, SAU, Dhaka.

5. a) Major Activities:

Planned Activities: (Amon season 2013)	Implementation Status
Selected NPT lines will be evaluated as Regional (OFT) by replicated yield trial	Selected one NPT lines were grown and yield per plant & yield/m ² were evaluated in RCBD design with 4 standard check varieties at 6 Agro Ecological Zones (AEZ) in collaboration with BRRI.
Quality characters of selected NPT lines will be evaluated	Quality characters of selected NPT lines including 4 checks were evaluated
Continuation of improvement of restorer lines by selfing and pedigree selection	5 selected restorer lines were grown and healthy and morphologically better plants were selected for selfing. Selfed seeds of restorer lines were collected for further improvement in the next Boro season.
Continuation of conversion of good maintainers into new CMS line by back crossing method	3 promising maintainer lines were back crossed (BC6F1) for conversion into new CMS lines. Seeds were collected from both female parent (BC6F1) and pollen parent and back cross will be continued coming Boro season 2012-2013.

5. b) Major Activities:

Planned Activities: (Boro season 2013-14)	Implementation Status
Seed multiplication of selected NPT lines will be done for DUS Testing	Seed multiplication of selected NPT lines is going on for DUS testing at seed certification agency for coming season.
Continuation of improvement of restorer lines by selfing and pedigree selection	5 selected restorer lines were grown and healthy and morphologically better plants will be selected for selfing. Selfed seeds of restorer lines will be collected for further improvement in the next Amon season.
Continuation of conversion of good maintainers into new CMS line by back crossing method	3 promising maintainer lines will be back crossed for conversion into new CMS lines. Seeds will be collected from both female parent (BC8F1) and pollen parent and back cross will be continued coming Amon season 2014.

6. Major Observation by the Monitoring Team: The team visited the field level research activities and observed satisfactory level of implementation status. The overall project activities have been done following the plan of action of the project.

7. Budgetary Information: i) Total Approved Budget (Project Period): TK. 9,00,000/-; ii) Fund released: TK. 7,25,000/-; iii) Fund spent: TK. 7,25,000/-

Development of Population for Gynodioecious Papaya Variety

- Objectives: i) To develop variety containing 100% productive plant; and ii) To increase farm income through papaya cultivation.
- Implementing Agency & Division: Pomology Division, HRC, BARI, Gazipur.
- Name of the Principal Investigator: Dr. Madan Gopal Saha, Chief Scientific Officer (CC), Pomology division, HRC, BARI, Gazipur.
- Implementation location: Fruit Research Farm, Pomology division, HRC, BARI, Gazipur.

5. Major Activities:

Planned Activities	Implementation Status
Identification and collection of hermaphrodite germplasm from domestic and exotic sources	16 germplasm have been collected Source: Local market and farmer's field
Evaluation, characterization and selection of superior lines	After first year evaluation and characterization, 22 plants were found andromonoecious type. Among them 9 plants have been selected as superior in terms of yield and taste.
Selfing of selected gynodioecious lines and crossing of selected female lines with hermaphrodite lines and evaluation of S1 and F1 progeny	Selfing and crossing were started from May 2013. Seeds were collected and sown in poly bag then seedlings of S1 and F1 progeny were planted in the field on February 2014.
Data collection, completion of result, standardization of the result	Data collection, compilation and preparation of report for 1st year have been completed and submitted.

6. Major Observations by the Monitoring Team: The team observed the experimental field in a very initial stage of planting. The PI and his team confirmed the monitoring team that the Papaya lines were collected from local source, which are Gynodioecious and the

lines are now evaluating in the field level. The experiment was found in good condition.

7. Budgetary Information: i) Total Approved Budget: Tk : 9,00,000/-; ii) Fund released: Tk.: 5,00,000/- (up to 3 March 2014); iii) Fund spent: Tk.: 4,88,909/- (up to 3 March 2014)

8. Constraints & Suggestions

Constraints	Suggestions
Inadequate trained manpower.	Higher training in abroad for capacity building of the scientists is required. Short visit in papaya growing country like USA (Hawaii), Taiwan and Thailand could be arranged.
Collection of germplasm from abroad is very difficult.	BARC may take necessary initiatives in collecting papaya germplasm from abroad as well as establishing international collaboration for the improvement of papaya in Bangladesh.
It would not be possible to draw a conclusion within the existing project period.	The project should be extended for another 3 years to draw a conclusion.

Export and Import Parity Analysis of Selected Vegetables and Spices in Bangladesh

1. Objectives: i. To find out export potentialities of selected vegetables in the different locations in the country; ii. To examine the import substitution status of the selected spices crops; iii. To examine the policy implications arising from the findings.

2. Implementing Agency & Division: Agricultural Economics Division, BARI, Gazipur

3. Name of the Principal Investigator: Dr. Md. Abdur Rashid, Principal Scientific Officer, Agricultural Economics Division, BARI, Gazipur

4. Implementation location: Jessor, Narshingdi, Rangpur, Comilla, Nilfamari and Munshiganj.

5. Major Activities:

Planned Activities	Implementation Status
Site selection and questionnaire preparation	Completed
Data collection	Data collection will be completed during May 2014
Review of literature and desk work	Completed
Compilation & Report Submission	June 2014

6. Major Observation by the Monitoring Team: The team observed that the researchers already collected necessary data from primary and secondary sources. Compilation and editing are going on for finalization of the report. The study has been carried out successfully according to the objectives of the project.

7. Budgetary Information: i) Total Approved Budget: Tk: 3,00,000/ (2nd year); ii) Fund released: Tk.: 1,50,000/-; iii) Fund spent: Tk.: 1,47,115/-

8. Constraints: Insufficient fund and delay in fund releas. Suggestions: Sufficient fund needed and Fund should be released in time.

Monitoring Report of Team-3

The team members were Mr. Md. Abeer Hossain Chowdhury, Director (Computer & GIS), BARC- (Team Leader), Dr. Mian Sayeed Hassan, PSO(Crops), BARC (Member) and Dr. Md. Abdul Awal, PSO (P&E), BARC (Member) on 3 March and 20 March 2014. The following projects were monitored by the

team. Two members of the team monitored the Projects.

Adaptation of heat tolerant tomato and photo insensitive country bean variety during summer season in Sylhet region

- Objective (s): (i)To introduce summer tomato and summer country bean variety in the Sylhet region of Bangladesh (ii) To adapt the suitable variety and production technologies of summer tomato and summer country bean
- Implementing Agency & Division/Section: Dept. of Horticulture, Sylhet Agricultural University, Sylhet
- Name & Designation of the Programme Leader with address: Position and Address: Dr. Md. Shahidul Islam, Associate Professor, Department of Horticulture, Sylhet Agricultural University.
- Implementation Locations: Sylhet Agricultural University campus and different Upzillas of Sylhet and Moulavibazar districts.

5. Major Activities:

Sl. No.	Planned activities	Implementation status
01.	Performance of photo insensitive country bean variety under varied sowing dates	Completed and data are under compilation for report writing
02.	Effect of sowing time on summer tomato production under Sylhet condition	Completed and data are under compilation for report writing
03	Adaptation trial of summer tomato and summer bean in farmer's field 2013	Completed and data are under compilation for report writing
04	Seed production of promising tomato hybrids	Parental seed sown on October 10, 2013 and transplanted on November 9 2013
05	Sowing of seeds of country bean variety for seed production	Seeds were sown on September 05, 2013 for breeder seed production
06	Procurement of research material	Bamboo, cow-dung, nylon net, sign board till 31 December 2013
07	Field day cum training workshop	One field day cum training workshop on summer tomato and summer bean production was organized on 21 September 2013 at Komolgonj, Moulavibazar, where farmers (20) and SAAO (5) from Moulavibazar Sadar, Sreemongal and Komolgonj upzilla were attended.

6. Budgetary Information: i) Total Approved Budget: Tk 5,00,000/-; ii) Fund released: Tk 2,50,000/- (Jan 31 2014); iii) Fund spent: Tk. 1,20,748/- (Jan 31 2013).

7. Any other Information: Production of tomato and bean during summer was found promising in Sylhet and Moulavibazar districts. Therefore, dissemination can be made to the other part of Sylhet division as well other districts of the country.

8. Comments: The field experiment and famers opinion was satisfactory.



Mr. Md. Abeer Hossain Chowdhury, Director (Computer & GIS), and Dr. Md. Abdul Awal, PSO (P&E), BARC visited the experimental field and consulted Principal Investigator. Dr. Md. Shahidul Islam, Associate Professor, Department of Horticulture, SAU.

Development of artificial breeding techniques of *Sperata aor*

1. Objective(s): i) To understand the breeding biology of *S. aor*, ii) To assess their reproductive potential in captive condition, and iii) To develop artificial breeding techniques
2. Implementing Agency & Division/Section: Department of Fisheries Biology and Genetics, Faculty of Fisheries, Sylhet Agricultural University.
3. Name & Designation of the Programme Leader: Dr. Mohammed Mahbub Iqbal, Assistant Professor, Department of Fish Biology and Genetics, Faculty of Fisheries, Sylhet Agricultural University, Sylhet-3100.
4. Implementation Locations: Sylhet Agricultural University, Sylhet and American Fish Farm Ltd., Zakigonj, Sylhet.

5. Major Activities:

Sl. No.	Planned Activities	Implementation Progress up to till date
1.	Gonad development	Early and developing stages oocytes were mostly observed during March-April and maturing oocytes in May. Presence of oocytes of all developmental stages in a single ovary indicated that <i>S. aor</i> possess a group asynchronous ovary. On the other hand, spermatozoa (SZ) in the sperm duct (SD) was observed in May; sperm duct became thicker or fuller due to the spermatozoa and fluids in them indicated that <i>S. aor</i> testes became mature in May. But the presence of numerous spermatocytes and spermatogonia in the testes during this time indicated that the egg fertilization can be performed for long time duration.
2.	Gonado somatic index	The GSI of female was found to be gradually increasing from January and the highest value was recorded in June. It was then declined sharply in July-August from where it was again increasing till October.
3.	Fecundity estimation	The average absolute fecundity was calculated 40952/kg fish.
4.	Nest building	We have found various sizes of nests on the bottom of the ponds. Average diameter and depth of nest was found 215.01 cm and 13.27 cm, respectively.
5.	Appearance change	It was found that only the male produce extra ordinary fluid on their body surface during their breeding season. The role of these fluids is yet to be known.
6.	Natural breeding	Natural breeding of <i>S. aor</i> was found in the experimental ponds. Fries were found from all ponds having artificial holes in May. But there was not any evidence of fries in the ponds with no artificial holes at the same time.
7.	Maturity enhancement	Certain dose of pituitary extract (PG) was injected to promote their gonadal development and ovulation effectively. But yet not succeed their ovulation effectively. Efforts are continuing for artificial breeding using PG, HCG and Ovaprin.

6. Budgetary Information: i) Total Approved Budget: Tk. 3,76,400/-; ii) Fund released: Tk. 1, 88, 000/-; iii) Fund spent: Tk.82, 878/-.

7. Constraints & Suggestions:

Sl No.	Constraints	Suggestions
1	Very sensitive to handle during transportation	Need to put single piece in a single pot in the transportation
2	Fries die too much in natural breeding	Need study more
3	Body abrasion in the cement made hatching tank	May need glass fiber tanks
4	Not attraction in artificial feed	Need to release small live fish regularly



Mr. Md. Abeer Hossain Chowdhury, Director (Computer & GIS), BARC- Team Leader, and Dr. Md. Abdul Awal, PSO (P&E), BARC-Member visited the experimental field.

Monitoring Report of Team-4

The team members were Dr. A.S.M. Anwarul Huq-CSO (AERS), (Team leader), Dr. Md. Abdul Awal PSO (P&E) – (Member) and Md. Abdul Mottakin DD (Budget), BARC (Member). The monitoring team

monitored the implementation progress of seven core research projects at BINA, BAU, Mymensingh. The following projects were monitored by the team.

Development of a remote controlled *guti* urea applicator, characterized by increased operational comfort, low cost and precise placement.

1. Implementing Agency & Division/Section: Department of Farm Power and Machinery, Bangladesh Agricultural University, Mymensingh-2202.
2. Coordinator/ Principal Investigator: Dr. A.T.M. Ziauddin, Professor, Department of Farm Power and Machinery, Bangladesh Agricultural University, Mymensingh
3. Implementation Locations: Engineering Workshop of the Department of Farm Power and Machinery, Bangladesh Agricultural University, Mymensingh.

4. Major Activities:

Sl.	Planned Activities	Implementation Status
1.	Analysis of field data and further improvement of the machine	Preliminary field data have been gathered. Further improvement of the device progressing
2.	Re-Test the machine in the field	Progressing
3.	Calculate technical & economic performance of the machine and report writing	To be done in March 2014 (Boro season)
4.	Conduct annual workshop	Completed
5.	Prepare a documentary video	To be done in May 2014
6.	Conduct field demonstrations	To be conducted in March-April 2014
7.	Handed over the technology to manufacturers for commercial use	-

5. Budgetary Information: i) Total Approved Budget: Tk. 5,52,500/-; ii) Fund released: Tk. 1,38,125/-; iii) Fund spent: Tk. 1,29,393/-

6. Constraints: Took long time to find out a suitable readymade power units (24 and 48 volt DC motor & battery).

7. Comments of the Monitoring Team: The experiment was satisfactory.



Dr. A.S.M. Anwarul Haq, CSO (AERS), Dr. Md Abdul Awal, PSO, P&E and Mr. Md. Mottakin, DD (Budget) visited the remote controlled guti urea applicator at farm power lab and consulted with Dr. A.T.M. Ziauddin, Professor, Department of Farm Power and Machinery, BAU

Biological nitrification inhibition is a novel approach for enhancing nitrogen use efficiency in cereal production.

1. Objective(s): i) Collection and evaluation of sorghum germplasms for BNI function; ii) To check the stability and ability of BNI from sorghum in the soil; iii) Evaluation of the nitrification inhibitory compound/s from sorghum on rice growth environment; iv) Physiological studies on the mechanisms effecting BNI-compounds release; mode of action of BNI release from roots; and v) Introduce the targeted trait of sorghum to the rice plant for genetic improvement of next generation cultivars through biotechnological approach.
2. Implementing Agency & Division/Section: Department of Crop Botany, Bangladesh Agricultural University, Mymensingh - 2202.
3. Coordinator/Principal Investigator: Prof. Dr. A.K.M. Zakir Hossain, Department of Crop Botany, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh
4. Implementation Locations: Growth Chamber, Glass House and Field Laboratory of the Dept of Crop Botany.

5. Major Activities:

	Planned Activities	Implementation Status
1.	To collect and evaluate the sorghum germplasms for BNI function	Only two cultivars of sorghum from Japan and India showed detectable BNI capacity
2.	To check the stability and ability of BNI from sorghum in the soil	The purified BNI compound is highly stable in the soil and able to inhibit nitrification process
3.	To evaluate of the nitrification inhibitory compound/s from sorghum on rice growth environment	Rice plant responded positively and improved nitrogen use efficiency
4.	Physiological studies on the mechanisms effecting BNI-compounds release; mode of action of BNI release from roots	NH_4^+ has the trigger effect to release BNI from sorghum
5.	Introduce the targeted trait of sorghum to the rice plant for genetic improvement of next generation cultivars through biotechnological approach.	Not yet started

6. Budgetary Information: Total Approved Budget Tk: 3,60,000.00/-; Fund released Tk: 1,18,000.00/-; Fund spent Tk: 1,76,000.00/-.

7. Constraints & Suggestions:

Constraints	Suggestions
Due to lack of available funding we could not ensure the desired instrumental facilities	In future we need to buy essential instruments for conducting advanced BNI research
Political instability was the major problem in this financial year for collecting seeds and other necessities	None
The project needs longer time to get substantial progress	Project can be extended with core research program funded from different programs

8. Any other Information: If possible, BARC can extend financial support for the promising research projects which has already achieved substantial progress (Journal articles & MS thesis) during project tenure.

Comments of the Monitoring team : The field and laboratory experiment was satisfactory.



Dr. A.S.M. Anwarul Huq, CSO (AERS), Dr. Md Abdul Awal, PSO, P&E and Mr. Md. Mottakin, DD (Budget) visited the BAU experiment field and consulted with Principal Investigator Prof. Dr. A.K.M. Zakir Hossain, Department of Crop Botany

5. Major Activities:

Planned Activities	Implementation Status
Collection and Characterization of <i>Trichoderma</i> spp and their bio-assay against wilt pathogens of vegetables	Completed
Determination of the efficacy of different substrates in the formulation of <i>Trichoderma harzianum</i> and their mass production technology	Completed
Net house assay (in Tray) of <i>Trichoderma</i> formulation against wilts and collar rot pathogens	Completed
Field evaluation of formulated <i>Trichoderma</i> against wilts and collar rot diseases of Tomato, chili and Indian spinach at BAU farm.	Completed
Training and field demonstration for plant doctors and vegetable growers	Partially Completed

6. Budgetary Information: i) Total Approved Budget: Tk. 9, 00,000/-; ii) Fund released: Tk. 7, 90,000/-; iii) Fund spent (to date): Tk. 7, 74,307/-.

An Integrated Approach for the Management of Wilts and Foot Rot /Collar Rot of Important Vegetables

1. Objective(s): i) To study the efficacy of *Trichoderma harzianum* as biocontrol agent against *Phytophthora capsici*, *Sclerotium rolsii* and *Ralstonia solanacearum* causing wilts and foot rot of vegetables; ii) To develop cost-effective, commercially viable mass production technology of *Trichoderma*.

2. Implementing Agency & Division/Section: IPM lab, Department of Plant Pathology, Bangladesh Agricultural University, Mymensingh.

3. Coordinator/ Principal Investigator: Dr. Mohammad Delwar Hossain(In-charge), Professor, IPM Lab, Department of Plant Pathology, Bangladesh Agricultural University, Mymensingh

4. Implementation Locations: IPM Lab, Plant Disease Clinic, Net House, Field laboratory of Department of Plant Pathology, BAU; Farms of vegetable growers of Mymensingh and Bogra.

7. Constraints & Suggestions:

Constraints	Suggestions
i. Budget for training and demonstration of technology of mass production of formulated Trichoderma is not sufficient.	Requested to allocate more budget in this regard
ii. Trichoderma could not grow at temperature $< 5^{\circ}\text{C}$,	Formulated Trichoderma should not be used in cool weather.
iii. Prices of chemicals are getting higher and higher that hits the budget	Additional budget is necessary in this regard



Dr. A.S.M. Anwarul Huq, CSO (AERS), Dr. Md Abdul Awal, PSO, P&E and Mr. Md. Mottakin, DD (Budget) visited the BAU experiment field and consulted with Principal Investigator Dr. Mohammad Delwar Hossain (In-charge), Professor, IPM Lab, Department of Plant Pathology, Bangladesh Agricultural University, Mymensingh

8. Any other Information: Both application and spraying of *Trichoderma* based biopesticide and *Trichoderma* spore suspension are being used in the field vegetables (Tomato, Chilli and Okra). Some experiments have been done while some are needed. Experimental results will help our farmer's integration of vegetable disease management options.

9. Comments of the monitoring Team: Most of the experiment plots were infested by weeds. Field condition of the experiment was not good.

Production of Somaclone *In vitro* for Drought Stress Tolerant Plantlet Selection in Potato

1. Objective(s): i) To establish a protocol on callus induction, proliferation and for high frequency plantlet regeneration through somatic embryogenesis.; ii) To develop a system for selection of somaclones *in vitro* under salinity and drought stress; iii) Isolation and development of salinity and drought tolerant strain for farmer use; iv) Capacity building and manpower development on *in vitro* somaclone production in potato; and v) Creation of knowledge on morpho physiological features and production potential of *in vitro* grown potato.

2. Implementing Agency & Division/Section: Department of Crop Botany, Bangladesh Agricultural University, Mymensingh - 2202.

3. Coordinator/Principal Investigator: Dr. Md. Obaidul Islam, Professor, Department of Crop Botany, Bangladesh Agricultural University, Mymensingh.

4. Implementation Locations: Department of Crop Botany, Bangladesh Agricultural University, Mymensingh.

5. Major Activities:

	Planned Activities	Implementation Status
1.	Establishment of meristem culture	Completed
2.	Callus derived somaclones production protocol establishment	Completed
3.	Draught Stress Tolerant Somaclones Production	Completed
4.	Hardening of plantlets	Completed
5.	Draught Stress Tolerant Plantlets Characteristics in the field	Partially Completed

Development of short duration high yielding rice varieties

1. Objective(s): To select and develop short duration high yielding rice varieties for the Boro, Aus and T. Aman seasons to fit into the existing cropping pattern.

2. Implementing Agency & Division/Section: Department of Genetics and Plant Breeding, Bangladesh Agricultural University, Mymensingh.

3. Coordinator/ Principal Investigator: Professor Dr. Lutful Hassan, Department of Genetics and Plant Breeding, Bangladesh Agricultural University, Mymensingh.

4. Implementation Locations: Experimentation field of Department of Genetics and Plant Breeding, Bangladesh Agricultural University, Mymensingh.

5. Major Activities:

	Planned Activities	Implementation Status
1.	Growing of F_2 seeds and Selection of desired F_2 genotypes through SSR markers (Aman season)	Completed
2.	Selection of advanced breeding lines for short duration high yielding rice developed by the department of Genetics & Plant Breeding, BAU	Completed

3.	On farm variety trial will be conducted with short duration advanced lines to look into the stable yield	In progress
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6. Budgetary Information: Total Approved Budget Tk: 3,25,670/-; Fund released Tk: 1,68,305/-; Fund spent Tk: 1,63,351/-.

7. Constraints: Project Duration is much limited. Suggestions: The project duration is to be extended for one year with additional budget allocation. It is important to get the advanced lines for short duration rice varieties.

Development of short duration high yielding and high yielding boro rice varieties through induced mutation

1. Objective(s): i) To develop short duration (115-120 days) boro rice variety (s) with 6.0-6.5 t/ha yield that can be transplanted after harvest of high yielding mustard/rapeseeds variety; ii) To develop boro rice variety (s) with high yield potential of 8.0-8.5 t/ha and 155-160 days maturity.

2. Implementing Agency & Division/Section: Plant Breeding Division, BINA, Mymensingh - 2202.

3. Coordinator/ Principal Investigator: Dr. Md. Abul Kalam Azad, CSO (CC), Plant Breeding Division, (BINA), Mymensingh.

4. Implementation Locations: BINA Farm, Mymensingh, BINA sub-station farms at Magura, Rangpur and Barisal, and farmer's field at Mymensingh, Magura, Rangpur and Barisal.

5. Major Activities:

Planned Activities	Implementation Status
Field evaluation of short duration mutant lines for release <ul style="list-style-type: none"> (i) Selection and preparation of land and raising seedlings of short duration boro rice. (ii) Transplanting of seedlings and intercultural operations (iii) Harvesting (iv) Training/field days 	This experiment was carried out during 2011-12 and the late transplanting potential, short duration and high yielding boro and T.aman rice variety Binadahan-14 has been released.
Zonal yield trial with m8 high yielding mutant lines boro rice. <ul style="list-style-type: none"> (i) Selection and preparation of land and raising seedlings of short duration boro rice. (ii) Transplanting of seedlings and intercultural operations (iii) Harvesting 	Seeds of the short duration high yielding mutants, RM(2)-40©-1-1-10 together with the parent variety, BRRRI dhan 29, were sown during 02 to 20 December, 2013 and transplanted during 09 to 31 January, 2014 at Mymensingh, Magura and Barisal both at on-station and at farmer's field. In contrast, at Rangpur due to severe cool weather seeds have been sown on 20 January and transplanted on 12 February 2014 at Rangpur substation and on 15 February 2014 at farmer's field.

6. Budgetary Information: Total Approved Budget Tk: 4,00,000/-; Fund released Tk: 2,00,000/-; Fund spent Tk: 1,55,813/-

7. Comments of the Monitoring Team: The field experiments and farmers opinion was satisfactory.



Dr. A.S.M. Anwarrul Huq, CSO (AERS), Dr. Md Abdul Awal, PSO, P&E and Mr. Md. Mottakin, DD (Budget) visited performance of short duration high yielding and high yielding boro rice varieties at BINA and consulted with Principal Investigator Dr. Md. Abul Kalam Azad, CSO (CC), Plant Breeding Division, (BINA), Mymensingh

Monitoring Report Presentation by Team- 5

Seven projects monitored implementation status of the Core Sub-Projects conducted by different research institute and university like BARI, BINA and BAU. The team leader and members were Dr. Md. Shamsher Ali, CSO (P & E), BARC; (Team Leader); Dr. Fauzia Yasmin, PSO (TTMU), BARC (Member) and Mr. Ajit Kumar Chakrabarty, DD (Accounts), BARC (Member). Following Projects were monitored by the team members on 11 to 13 February 2014.

Projects Monitored

Sl. No.	Title	Implementing Institutes	Name of PI's
1.	Study on Fish Disease and Health Management in Rural Aquaculture	BAU	Dr. Md. Ali Reza Faruk Professor (Aquaculture)
2.	Study of Reproductive Endocrinology of Mud Eel <i>Monopterus Cuchia</i> for Artificial Propagation	BAU	Dr. Harunnur Rashid Professor (Fisheries Management)
3.	Production of Genetically Male Tilapia by Identification of YY Super Males using Micro Satellite DNA Marker	BAU	Dr. Md. Golam Kader Associate Professor (Fisheries Biology & Genetic)
4.	Development of Breeding and Fry Rearing Techniques of Endangered Tenra, <i>Mystus Vittatus</i> and Gulsha, <i>Mystus Cavasius</i>	BAU	Dr. Md. Rafiqul Islam Professor (Fisheries Biology & Genetic)
5.	Epidemiological Investigation of Anthrax and Determination of Efficacy of Local Anthrax Vaccine in Bangladesh	BAU	Dr. Md. Zayedul Hassan Assist. Professor (Micro Biology & Hygiene)
6.	Collection of Some Targeted Threatened Plant Species of Sylhet Forests for Sustainable Management and Curation	BAU	Dr. Md. Mustafizur Rahman Professor (Crop Botany)
7.	Increasing Nitrogen Use Efficiency through Nitrogen and Management in the Rice-Rice Cropping Pattern	BAU	Dr. Mahmud Hossain Sumon Associate Professor (Soil Science)

Study on Fish disease and Health Management in Rural Aquaculture

- Objectives: i) To identify and characterize pathogens involved in fish disease; ii) To develop fish health management and disease treatment protocol.
- Implementing Agency and Division: BAU, Mymensingh.
- Principal Investigator: Dr. Md. Ali Reza Faruk, Professor (Aquaculture) BAU, Mymensingh.
- Implementation locations: Department of Aquaculture, BAU, Mymensingh.

5. Major Activities:

Sl. No.	Planned major activities	Actual attainment
1.	Collection of diseased fishes from rural farms	Completed
2.	Isolation, identification and characterization of bacterial pathogens	About complete to
3.	Pathogen test of bacteria, histopathology analysis and treatment trial	On-going

6. Budgetary Information: Total approved cost: Tk. 4,00,000/-; Fund released: Tk. 2,00,000/-; Fund spent: Tk. 1,38,500/-.

7. Persons interviewed: Date of visit: 12.2.2014 Dr. Md. Ali Reza faruk, Professor (Aquaculture), BAU, Mymensingh.

8. Any other observation: Overall performance is satisfactory; Almost complete the portion of research; Disease and health management for different types of fishes is needed. That is why time extension in needed.



Dr. Md. Shamsher Ali, CSO (P&E), Dr. Fauzia Yasmin, PSO (TTMU) and Mr. Ajit Kumar Chakrabarty, DD (Accounts) visited the fish disease and health management lab at BAU and consulted with Dr. Md. Ali Reza Faruk, Professor (Aquaculture) BAU

Production of genetically male tilapia by identification of YY super males using micro satellite DNA markers

1. Objectives: i) To produce neo-female (genetically male but phenotypically female) by hormonal sex reversal; ii) To produce putative YY super males by genetic manipulation and progeny testing; iii) To identify 'true' YY super males from XY males using sex-linked micro satellite DNA markers in Nile tilapia.

2. Implementing Agency and Division: MAU, Mymensingh.

3. Principal Investigator: Dr. Mohd. Golam Quader Khan, Associate Professor (Aquaculture), BAU, Mymensingh.

4. Implementation locations: Department of Fisheries Biology and Genetics, BAU, Mymensingh; Reliance Aquafarm, Boilor Trisal.

5. Major Activities:

Sl. No.	Planned major activities	Actual Attainment
1.	Hormonal sex reversal	Completed
2.	Determination of sex reversal rate with acetocarmine gonad squashing method	Completed
3.	Rearing DES treated fry	Completed
4.	Separation of male and female	Completed
5.	Breeding of HRT (hormone treated) groups	Completed
6.	Breeding of samples from (5) with XY males	Completed
7.	Identification of XY female groups	Completed
8.	Rearing of putative YY progeny	On-going

6. Persons interviewed: Date of visit: 12.2.2014 Dr. Mohd. Golam Quader Khan, Associate Professor (Aquaculture), BAU, Mymensingh

7. Any other observation: Overall performance is satisfactory; Improve quality marker needs to be used;

PCR machine found inactive, that is why time needs to extent up to 6 months.

Study of reproductive endocrinology of mud eel *monopterus cuchia* for artificial propagation

1. Objectives: i) To understand different aspects of reproductive biology of *M. cuchia* through study of GSI and gonadal maturity stages; ii) To identify the location of GnRH and GtH genes in the brain and pituitary by immunohistochemistry; and iii) To trial advanced maturation and spawning using specific GnRH-analog.

2. Implementing Agency and Division/Section: BAU, Mymensingh.

3. Principal Investigator: Dr. Harunur Rashid, Professor & Head (Fisheries Management) BAU, Mymensingh.

4. Implementation locations: Department of Fisheries Management, BAU, Mymensingh.

5. Major Activities

Sl. No.	Planned major activities	Actual Attainment
1.	Brood acclimatization in captivity	Complete
2.	Identifying food & feeding of <i>M. cuchia</i>	Complete
3.	Live food culture for <i>M. Cuchia</i> and feeding	Complete
4.	Investigating different aspects of reproduction physiology of <i>M. Cuchia</i>	Complete
5.	Immunohistochemical localization of GnRHs and GtH	On-going
6.	Induced breeding trial	Partial success

6. Budgetary Information: Total approved cost: Tk. 3,96,000/-; Fund released: Tk. 1,98,000/-; Fund spent: Tk. 82,350/-.

7. Persons interviewed: Dr. Harunur Rashid, Professor & Head (Fisheries Management), BAU, Mymensingh

8. Constraints & Suggestions:

Constraints	Suggestions	Observations
i. Disease in brood fish during pond rearing ii. Escaping of brood fish from pond borrowing holes iii. The fit of fish from hapa. iv. Unavailability of GaRHs antibody.	i. Further studies are required to identify neuroendocrine mechanism of reproduction of this fish ii. Monitoring and surveillance of govt. agencies are required to prevent indiscriminate harvest to this threatened species	i. Overall performance is satisfactory ii. Security is needed to stop thriving of ell iii. Need more management from escaping ell by borrowing mud hole iv. 6 months time needs to extent

Development of breeding and fry rearing techniques of endangered Tengra, *Mystus vittatus* and Gulsha, *Mystus cavasius*

1. Objectives: i) To develop a captive brood stock of Tengra and Gulsha using wild collected fish; ii) To develop breeding protocol using different inducing agents and their dose optimization; and iii) To establish fry rearing techniques.

2. Implementing Agency and Division: BAU, Mymensingh.

3. Principal Investigator: Dr. Md. Rafiqul Islam Sarder, Professor (Fisheries Biology and Genetics) BAU, Mymensingh.

4. Implementation locations: Department of Fisheries Biology and Genetics, BAU, Mymensingh.

5. Major Activities:

Sl. No.	Planned major activities	Actual attainment
1.	Collection of fish samples	Continued
2.	Stocking and rearing in the pond	Continued
3.	Monthly growth performance	Completed
4.	Gonado-somatic index and fecundity	Continued
5.	Histological observation of gonads	Continued
6.	Artificial breeding and dose optimization	Continued

6. Budgetary Information: Total approved cost: Tk. 11,80,000/-; Fund released: Tk. 9,89,990/-; Fund spent: Tk. 8,85,165/-.

7. Persons interviewed: Date of visit: 12.2.2014. Dr. Md. Rafiqul Islam Sarder, Professor (Fisheries Biology and Genetic), BAU, Mymensingh.

8. Constraints & Suggestions

Sl. No.	Constraints	Suggestions	Observations
1.	Fish of wild source are	Fish need to be collected whenever available	v. Overall performance is satisfactory
2.	Not available	Domestication in ponds and cisterns should be done with quality feed. Ponds need to be dried out for harvesting the fish	vi. Each teacher should involve with this type of project to teach their student about research
3.	Domestication and harvesting are quite difficult	Breeding technique with stripping method should developed	
4.	Induced breeding by stripping method is quite difficult. Some of the inducing agents are not available	Inducing agents should collected whenever available	

Collection of some targeted threatened plant species of sylhet forests for sustainable management and curation

1. Objectives: i) Capacity building of the Botanical Garden of BAU for collection, propagation and conservation of plants; ii) Enrichment of plant diversity in the garden, particularly the diversity of threatened plant species; and iii) To develop the Botanical Garden as a resource centre for biodiversity education, research and information.

2. Implementing Agency and Division/Section: Bangladesh Agriculture University, Mymensingh.

3. Principal Investigator: Mr. Md. Mustafizur Rahman, Professor (Crop Botany), Faculty of Veterinary Science, BAU, Mymensingh.

4. Implementation locations: Botanical Garden, BAU, Mymensingh.

5. Implementation Progress of Research Activities:

Sl. No.	Planned major activities	Actual attainment	Remarks
1.	Enrichment of diversity of threatened plant species	A total 36 plant species have so far been collected out of 43 species targeted	-
2.	Increasing awareness and education on plant diversity	ii. Followed the Bentham and Hooker's classification system iii. 80% of all plant collections have been tagged with name plates	-
3.	Enhancement of biodiversity information	ix. Documentation of plant holdings x. Preparation of computerized database	-
4.	Nursery	A nursery has been established in the garden for propagation and multiplication of endanger plant species	-

6. Budgetary Information: Total approved Tk.3,87,160; Fund released: Tk. 1,93,440; Fund spent: Tk.1,51,080/-

7. Persons interviewed: Mr. Md. Mustafizur Rahman, Professor (Crop Botany), BAU, Mymensing.

8. Constraints & Suggestions

Constraints	Suggestions	Observations
9 targeted plant species are not available in their expected location	May be available in different places	xi. Overall performance is satisfactory xii. Needs to continue this type of research

Increasing nitrogen use efficiency through nitrogen and water management in the rice-rice cropping pattern curation

1. Objectives: i) To figure out the nutrient dynamics and NUE in the rice-rice cropping sequence treated with slow release N fertilizer under different water regimes; ii) To screen N use efficient rice varieties for the rice-rice cropping pattern; and iii) To examine the changes in physico-chemical properties of soils

including electrical conductivity (EC), pH, soil organic matter status, soil N etc.

2. Implementing Agency and Division/Section: BAU, Mymensingh

3. Principal Investigator: Dr. Mahmud Hossain Sumon, Associate Professor (Soil Science), BAU, Mymensingh.

4. Implementation locations: Soil Science Field Laboratory, BAU, Mymensingh.

5. Major Activities:

Sl. No.	Planned major activities	Actual attainment	Remarks
1.	Labour recruitment	One unskilled labour working for the smooth running of the project	-
2.	Soil collection	Soils were collected from the individual plots after first year experiment (Boro)	-
3.	Soil analysis	Soils were analysed for N,P,K and S	-
4.	Field experiments with T.Aman rice	A total of 13 high yielding aman rice varieties were tested for their nitrogen use efficiency in a variety screening experiment. Pore water sampling was done using Rhizon sampler and analysed pH, NH ₄ -N and NO ₃ -N. The crops were harvested at full maturity stage.	-
5.	Chemical analysis of plant samples	N,P,K and S analysis of grain and straw are continuing	-
6.	Fields experiments with Boro rice	Boro rice seedlings are ready to be transplanted in the field	-
7.	Procurement of equipments, chemicals & glassware	Chemicals for pore water, soil, grain and straw analysis were purchased	-

6. Budgetary Information: Total approved cost: Tk. 3,00,000/-; Fund released: Tk. 1,49,992/-; Fund spent: Tk. 85875/-.

7. Persons interviewed: Dr. Mahmud Hossain Sumon, Associate Professor (Soil Science), BAU, Mymensingh

8. Constraints and Suggestions:

Sl. No.	Constraints	Suggestions	Observations
1.	Delay in procurement process	Approval of the procurement plan by BAURES needs to be speeded up	Overall performance is satisfactory Approval of the procurement plan by BAURES needs to be speeded up
2.	Delay of fund release	Funds needed to be released at the beginning of the financial year	Funds should be release the beginning of the financial year.

Epidemiological Investigation of Anthrax and Determination of Efficacy of Local Anthrax Vaccine in Bangladesh

1. Objectives: i) To determine the environmental factors (soil type, pH, geographical location, temperature, humidity, season etc.) responsible for the outbreak of anthrax; ii) to determine the host factors (age, sex, breed, nutritional status, immune status) associated with the outbreak of anthrax; iii) to determine the role of managerial (feeding, bedding, watering, prevention and control measures etc.) and vector system in transmitting the disease; iv) to isolate

and characterize *B. anthracis* from the suspected sources; and v) to determine the efficacy of local anthrax vaccine produced by LRI, Mohakhali, Dhaka.

2. Implementing Agency and Division/Section: BAU, Mymensingh

3. Principal Investigator: Mr. Jayedul Hassan, Assist. Professor (Microbiology and Hygiene), Faculty of Veterinary Science, BAU, Mymensingh.

4. Implementation locations: Five thanas of Tangail, Sirajgong, Pabna, Kushtia and Bogra.

5. Major Activities:

Sl. No.	Planned major activities	Actual attainment	Remarks
1.	Field survey and selection of target area	Completed	-
2.	Epidemiological investigation of the factors associated with anthrax outbreak in Bangladesh	Completed	-
3.	Isolation and characterize <i>B. anthracis</i> from the suspected sources	Completed	-
4.	Determination of immune status of target general animal population before and after vaccination	On-going	-

6. Budgetary Information: Total approved cost: Tk. 12,00,000/-; Fund released: Tk. 10,10,000/-; Fund spent: Tk. 10,07,000/-

7. Persons interviewed: Mr. Jayedul Hassan, Assist. Professor (Microbiology and Hygiene), Faculty of Veterinary Science, BAU, Mymensingh.

8. Constraints & Suggestions

Constraints		Observations
Fund release Microbiological laboratory settings	Authority should consider to release of fund in one/two slot instead of 4 different slots in a year At least a room of the Microbiology department may be established as BSL3. Accordingly funding source may be fund out. BARC should take care of it.	*Overall performance is satisfactory * Needs to continue this type of research according to demand

Monitoring Report of Team-6

Eight projects monitored implementation status of the Core Sub-Projects conducted by different research institute and university like BARI, BINA and BAU. The team leader and members were Dr. Kabir Ikramul Haque, MD (Fisheries), BARC; (Team Leader); Mr. Md. Aminuzzaman, Director (M&T), BARC (Member); Dr. Shah Md. Ziqrul Haq Chowdhury CSO, Livestock Division, BARC (Member). Following Projects were monitored by the team members.

BARI: RARS, Jamalpur

- Evaluation of short duration high yielding rapeseed- mustard varieties/lines for cultivation between T.Aman and Boro rice

BINA:

- Development of short duration high yielding and high yielding boro rice varieties through induced mutation.

BAU:

- Development of short duration high yielding rice varieties
- An Integrated Approach for the Management of Wilts and Foot Rot /Collar Rot of Important Vegetables
- Production of Somaclone *In vitro* for Drought Stress Tolerant Plantlet Selection in Potato
- Biological Nitrification Inhibition is a novel approach for enhancing nitrogen use efficiency in cereal
- Remote Controlled Gutti Urea Applicator
- Epidemiological Investigation of Anthrax and Determination of Efficacy of Local Anthrax Vaccine in Bangladesh

Evaluation of short duration high yielding rapeseed-mustard varieties/lines for cultivation between T.Aman and Boro rice

1. Objective (s): i) To evaluate and selection of rapeseed-mustard lines suitable for growing between T. Aman and Boro rice ii) To replace local Tori-7 variety by high yielding short duration variety(s) and to provide an opportunity to the farmers to select appropriate varieties/lines adapted to their local condition iii) To increase production and area of rapeseed- mustard.

2. Implementing Agency: RARS, BARI, Jamalpur.

3. Principal Investigator: Dr. Md. Manjurul Kadir, PSO, RARS, BARI, Jamalpur.

4. Implementation locations: Jamalpur and Sherepur Districts.



The team comprised of Dr. Shah Md. Ziqrul Haq Chowdhury CSO, Livestock Division, BARC; Mr. Md. Aminuzzaman, Director (M&T), BARC visiting the experimental field

5. Major Activities:

Sl. No.	Planed activities	Implementation Status
01	On station screening of rapeseed-mustard varieties/lines (1st Cycle)	<ul style="list-style-type: none"> • 20 lines of each of <i>B. campestris</i> and <i>B. napus</i> were screened. • For each, 8 lines were selected.
02	Cultivation of short duration T aman rice in 10 farmer's field (July-Oct. 12)	<ul style="list-style-type: none"> • BINADhan-7 was used in Jamalpur and Sherpur-Av. 115-120days, av. yield-10mond/Bigha
03	Evaluation of Rapeseed lines/varieties in farmer's field (Nov. 2012-Jan. 2013)	<ul style="list-style-type: none"> • 8 lines of <i>B. campestris</i> + 8 lines of <i>B. napus</i> -Evaluated in the same Farmers field. • Nap-0733-1, Nap-0865, Nap-205 and Nap-0660, BC-0828-1, BC-08-10 and BC-08-4 performed better (5-6 mond/Bigha). • Check variety: Tori-7
04	Cultivation of Boro rice at the farmers field (Feb.-May, 2013)	<ul style="list-style-type: none"> • BRRIdhan-28 was used that has been harvested. • Yield of BRRIDhan-28 is around 15.0-18.0 mond/Bigha.

6. Budgetary Information: i) Total Approved Budget: Tk.7,00,00/-; ii) Fund released: Tk. 3, 58,750/-; iii) Fund spent: Tk. 3,04,216/-.
7. Constraints & Suggestions: i) White mould and *Alternaria* blight were two severe diseases of rapeseed mustard. ii) Rovral was used to control, price of which increases every year, which the Farmers cannot afford. iii) Authority should take initiatives so that availability of the fungicide should be ensured
2. Implementing Agency: Plant Breeding Division, BINA
3. Principal Investigator: Dr. Md. Abul Kalam Azad, PSO, Plant Breeding Division, BINA

Development of short duration high yielding and high yielding boro rice varieties through induced mutation

1. Objective (s): i) To develop boro rice variety(s) with yield potential of 8.0-8.5 t/ha and 155-160 days

4. Implementation Locations: BINA Farm (Mymensingh); BINA sub-station farms at Magura, Isurdi, Rangpur & Barisal; BINA Annex farm at Jamalpur and Farmers's field at Mymensingh, Jamalpur, Isurdi, Rangpur, Magura and Barisal.

5. Major Activities:

Sl.No.	Planned activities	Implementation Status
On-farm and on-station trial with 2 short duration Boro Mutant Lines		
01	Selection and preparation of land and raising seedlings of 2 mutants- RM-(1)-200(C)-1-10 and RM-(1)-200(C)-1-17 compared with BRRIdhan 28	Done during 09 to 29 January 2013
02	Transplanting of seedlings and intercultural operations at 10 locations (5 on-stations & 5 at farmers' fields)	Transplanted during 22 February to 08 march 2013
03	Harvesting	rd 3 week of May 2013 and data were collected for statistical analysis
04	Training/field days	The comparative field performance of these two mutant lines has been evaluated by NSB team.
Advance yield trial with M ₇ high yielding mutant lines of boro rice		
01	Selection and preparation of land and raising seedlings of HYV boro rice of six mutants compared with BRRIdhan 29 at 4 locations (Mymensingh, Magura, Rangpur and Barisal)	Done during 8-26 January 2013
02	Transplanting of seedlings and intercultural operations	Transplanted during 24 January to 26 February 2013
03	Harvesting	Harvested in 1st week of June 2013 at Mymensingh and Barisal, and harvesting stage at other locations

6. Budgetary Information: (i) Total Approved Budget: Tk: 4,00,000.00, (ii) Fund released (to date): Tk: 3,00,000.00

Development of short duration high yielding rice varieties

1. Objective (s): To select and develop short duration high yielding rice varieties for the Boro, Aus and

- T. Aman seasons to fit into the existing cropping pattern.
2. Implementing Agency: Dept. of Genetics and Plant Breeding, BAU.
3. Principal Investigator: Professor Dr. Lutful Hassan, Dept. of Genetics and Plant Breeding, BAU.
4. Implementation Locations (Trial site): Mymensingh Sadar, Haluaghat, Muktaghacha and On-station.

5. Major Activities:

Sl. No.	Planned activities	Implementation Status
01	Growing of F1 population and collection of F2 seeds (Boro season) for short duration and higher yield	Done
02	Growing of F1 seeds and collection of F2 seeds (Aus season) for short duration and higher yield	Done
03	Growing of F2 seeds and Selection of desired F3 genotypes (Aman season)	100% Completed
04	Selection of advanced breeding lines for short duration high yielding rice developed before by the Dept. of Genetics & Plant Breeding, BAU	100% Completed
	On farm variety trial will be conducted with short duration advanced lines to look into the stable yield	100% Completed

6. Budgetary Information: i) Total Approved Budget: Tk. 9,50,000/- ii) Fund released (to date): Tk: 5,50,589/- iii) Fund spent (to date): Tk: 5,44,431/-.

7. Constraints & Suggestions: i) Budget for the last quarter of 2012-13 needs to be released soon.

ii) Authority should take care of it.

8. Any other Information: This is a good project that should be continued.

An Integrated Approach for the Management of Wilts and Foot Rot/Collar Rot of Important Vegetables

1. Objective (s): i) To study the efficacy of *Trichoderma harzianum* as biocontrol agent against *Fusarium oxysporum* (fungus), *Sclerotium rolfsii* (fungus), *Ralstonia solanacearum* (bacteria), *Meloidogyne javanica* (nematode) and causing wilts and foot rot of vegetables, ii) To formulate *Trichoderma* as bio-control agent for controlling wilts and foot/collar rot of vegetables, and iii) To develop

cost-effective, commercially viable mass production technology of *Trichoderma*.

2. Implementing Agency: IPM lab, Dept. of Plant Pathology, BAU.

3. Principal Investigator: Professor Dr. Mohammad Delwar Hossain (In-charge), IPM lab, Dept. of Plant Pathology, BAU.

4. Implementation Locations (Trial site): IPM Lab, Plant Disease Clinic, Net House, Field lab. of Dept. of Plant Pathology, BAU, Farms of vegetable growers of Mymensingh and Bogra.

5. Major Activities:

Sl. No.	Planned activities	Implementation Status
01	Collection and Characterization of <i>Trichoderma</i> spp and their bio-assay against wilt pathogens of vegetables	Completed
02	Determination of the efficacy of different substrates in the formulation of <i>Trichoderma harzianum</i>	Completed
03	Net house assay (in Tray) of <i>Trichoderma</i> formulation against wilts and collar rot pathogens	Completed
04	Field evaluation of formulated <i>Trichoderma</i> against wilts and collar rot diseases of Tomato, chili and Indian spinach at BAU farm.	Completed
05	Training and field demonstration for plant doctors and vegetable growers	Partially done

6. Budgetary Information: (i) Total Approved Budget: Tk.: 9,00,000/- (ii) Fund released: Tk: 5,95,000/- (iii) Fund spent: Tk.: 5,84,632/-

7. Constraints & Suggestions: i) Budget is not sufficient for training and demonstration of technology: P.I. should apply to the authority with proper justification ii) *Trichoderma* could not grow at temperature down to 5°C: Formulated *Trichoderma* should not be used in cool weather iii) Prices of

chemicals are getting higher and higher that hits the budget.

6. Any other Information: This is a good project and the progress is satisfactory.

Production of Somaclone In vitro for Drought Stress Tolerant Plantlet Selection in Potato

1. Objective (s): i) To establish a protocol on callus induction, proliferation and high frequency plantlet regeneration through somatic embryogenesis ii) To develop a system for selection of somaclones *in vitro* under drought stress iii) Isolation and

development of drought tolerant strain for farmers use iv) Capacity building and manpower development on *in vitro* somaclone production in potato v) Creation of knowledge on morpho-physiological features and production potential of *in vitro* grown plantlets of potato.

2. Implementing Agency: Dept. of Crop Botany, BAU
3. Principal Investigator: Prof. Dr. M. Obaidul Islam, Dept. of Crop Botany, BAU.
4. Implementation Locations: T.C. Lab. and Field lab., Dept. of Crop Botany, BAU.

5. Major Activities:

Sl. No.	Planned activities	Implementation Status
01. Drought Stress Tolerant Somaclones Production:		
	Node derived callus culture in PEG supplemented medium	Completed
	Selection of stress tolerant plantlets	Completed
02. Hardening and cultivation of plantlets:		
	Plantlet hardening in room (The rooted part or the part that inside the media washed with tap water. Whole plantlets were kept over toilet paper and sprayed with also tap water)	Completed
	Transplantation of screened plantlets in field	Completed
	Agronomic care and management of plantlets	Completed
	Harvesting of potato from selected plants in the field	Completed
03.	Storing mini tuber (20-24 mm) & breeder tuber in Lab.	On going

6. Budgetary Information: i) Total Approved Budget: Tk.9,00,000/- ii) Fund released: Tk.5,24,250/- iii) Fund spent: Tk.5,24,250/-.

7. Constraints & Suggestions: i) Load shedding due to no-electricity: Principal Investigator. should discuss the matter with BAU and electricity authority. ii) Impurities of supplied chemicals: P.I. should internally manage. iii) Lack of storing facilities of mini/breeder tubers: P.I. should discuss with his authority.

8. Any other Information: This is a good project and the progress is satisfactory. P.I. said, for the field study, it is needed a bigger fund and facilities for safe and successful production and selection of tolerant lines in future.

Biological Nitrification Inhibition is a novel approach for enhancing nitrogen use efficiency in cereal

1. Objective (s): i) To collect and evaluate the sorghum germplasms from different regions for BNI function, ii) To check the stability and ability of BNI from sorghum in the soil, iii) To evaluate of the nitrification inhibitory compound/s from sorghum on rice growth

environment, iv) Physiological studies on the mechanisms effecting BNI-compounds release; mode of action of BNI release from roots, and v) Introduce the targeted trait of sorghum to the rice plant for genetic improvement of next generation cultivars through biotechnological approach.

2. Implementing Agency: Dept. of Crop Botany, BAU.
3. Principal Investigator: Prof. Dr. A.K.M. Zakir Hossain, Dept. of Crop Botany, BAU.
4. Implementation Locations: Plant Physiology Lab., Crop Botany Field Lab., Prof. Muhammed Hossain Central Lab., BINA Lab.

5. Major Activities:

Sl. No.	Planned activities	Implementation Status
01	Evaluate the ability and stability of the identified nitrification inhibitory compound from sorghum in the soil	the identified compound has the ability to stay in the soil for longer period of time (Stability 53% and stability 40-50% even after 60 days)

02	Collection and evaluation of sorghum germplasms for high BNI production	Among the tested sorghum varieties, none of the varieties from home and abroad showed detectable BNI capacity except hybrid sorgho from Japan
03	To evaluate of the nitrification inhibitory compound/s from sorghum on rice growth environment	BNI has the significant contribution in increasing nitrogen use efficiency (20-25%) in rice production
04	Physiological studies on the mechanisms effecting BNI-compounds release; mode of action of BNI release from roots	The results showed that NH ₄ has the trigger effects for BNI release from roots.
05	Identified and introduce the targeted trait of sorghum to the rice plant for genetic improvement of next generation cultivars through biotechnological approach	Based on the results of more physiological studies, necessary experimental design will be undertaken

6. Budgetary Information: i) Total Approved Budget: Tk. 11,40,000/- ii) Fund released (to date): Tk. 6,00,000/- iii) Fund spent (to date): Tk. 5,80,000/-

7. Constraints & Suggestions: i) Fund release was little bit delayed for second installment of the current year: Authority should take care of it.

8. Any other Information: This is a good project which ultimately may contribute to reduce nitrogen fertilizer in cereal production system.

Remote Controlled Guti Urea Applicator

1. Objective: Development of a remote controlled guti urea applicator, characterized by increased operational comfort, low cost and precise placement.

2. Implementing Agency: Dept. of Farm Power and Machinery, BAU.

3. Principal Investigator: Prof. Dr. A.T.M. Ziauddin, Dept. of Farm Power and Machinery, BAU.

4. Implementation Locations: Dept. of Farm Power and Machinery, BAU.

5. Major Activities:

Sl. No.	Planned activities	Implementation Status
01	Study on available design & prototypes; remote control mechanism	100% completed
02	Prepare design of the proposed device.	100% completed
03	Estimate the required power of the battery, the Dc motor & the remote control unit	95% completed
04	Purchase construction materials and equipment	95% completed
05	Manufacture of first version of the device	100% completed
06	Conduct Lab. and field trial with the first version	100 % completed
07	Further physical improvement of the device and second version developed	80% completed
08	Preliminary field trial	20% completed
09	Further modification and field trial	20% completed

6. Budgetary Information: i) Total Approved Budget: Tk. 12,87,500/- (3 years) ii) Fund released (to date): Tk. 6,38,000/- iii) Fund spent (to date): Tk. 4,92,203/-

7. Constraints & Suggestions: Activities were performed with difficulties due to political unrest in the country. Some activities were done with time lag of two months: Common problem.

8. Any other Information: A local workshop has been scheduled in the third week of June'13. This is a good project targeting to develop a farmer's friendly simple device of USG applicator and the project should be continued.

Epidemiological Investigation of Anthrax and Determination of Efficacy of Local Anthrax Vaccine in Bangladesh

1. Objective(s): i) To determine the environmental factors (soil type, pH, geographical location, environmental temperature, humidity, season etc.) responsible for the outbreak of anthrax. ii) To determine the host factors (age, sex, breed, nutritional

status, immune status) associated with the outbreak of anthrax. iii) To determine the role of managerial (feeding, bedding, watering, prevention and control measures etc.) and vector system in transmitting the disease. iv) To isolate and characterize *B. anthracis* from the suspected sources. v) To determine the efficacy of local anthrax vaccine produced by LRI, Mohakhali, Dhaka.

2. Implementing Agency: Dept. of Microbiology and Hygiene, BAU.

3. Principal Investigator: Assist. Prof. Jayedul Hassan, Dept. of Microbiolog and Hygiene, BAU.

4. Implementation Locations: Five thanas of Tangail, Sirajgong, Pabna, Kushtia and Bogra.

5. Major Activities:

Sl. No.	Planned activities	Implementation Status
01	Field survey and selection of target area	100% Completed
02	Epidemiological investigation of the factors associated with anthrax outbreak in Bangladesh	95% Completed
03	Isolation and characterize <i>B. anthracis</i> from the suspected sources	95% Completed
04	Determination of immune status of target general animal population before and after vaccination	95% Completed

6. Budgetary Information: i) Total Approved Budget: Tk.12,00,000/- (3 years) ii) Fund released (to date): Tk. 7,22,500/- iii) Fund spent (to date): Tk. 6,94,648/-.

7. Constraints & Suggestions: i) Fund release: Authority should consider to release fund in one/two slot instead of 4 different slots in a year. ii) Microbiological laboratory settings: At least a room of the Microbiology Department may be established as BSL-3.

8. Any other Information: This is a good project of working with an important remarkable disease, Anthrax. The project should be continued.

Monitoring Report Presentation by Team- 7

Three projects monitored implementation status of the Core Sub-Projects conducted by different research institute and university like BARI, BINA and BAU. The team leader and members were Dr. S M Khalilur Rahman, Member-Director (AERS), BARC; (Team Leader); Dr. S M Khorshed Alam, PSO (Crops), BARC, (Member) and Mr. Md. Mustafizur Rahman, PTO, BARC (Member). Following Projects were monitored by the team members on 13 to 15 February 2014:

Projects Monitored

Sl. No.	Title	Implementing Institutes	Name of PI's
1.	Development and dissemination of a low cost power tiller operated potato planter	BARI, Shyampur, Rajshahi	Dr. Md. Israil Hossain Principal Scientific Officer RWRC, BARI, Shyampur, Rajshahi
2.	Soil water and nitrogen management for sustainable crop production in drought prone areas of Bangladesh using nuclear techniques	Soil Science Division, BINA, BAU Campus, Mymensingh-2202.	Hafez Md. Ekram ul Haque, PSO, Soil Science Division
3.	Improvement of gladiolus quality and its adaptation.	Floriculture Division, HRC, BARI, Joydebpur, Gazipur-1701	Dr. Kabita Anzu-Man-Ara, PSO, Floriculture Division, HRC, BARI, Joydebpur, Gazipur-1701

Development and dissemination of a low cost power tiller operated potato planter

1. Objectives: i) To develop a cup type potato planter cum fertilizer applicator matching with power tiller; ii) To evaluate machine performance and disseminate among the farmer's field; iii) To compare the economic benefit of the potato planter with conventional manual planting.

2. Implementing Agency & Division/Section: RWRC, BARI, Rajshahi.

3. Name & Designation of the Program Leader with address: Dr. Md. Israil Hossain, Principal Scientific Officer, RWRC, BARI, Shyampur, Rajshahi.

4. Implementation Locations: BARI, Shyampur, Rajshahi.

5. Major Activities:

Sl. No.	Planned Activities	Implementation Status
1.	Fabrication of power tiller operated potato planter	Already Fabricated
2.	Compare the technology with conventional methods	Compared and it was found more cost effective than the conventional ones. Around 70% labor cost could be saved.
3.	Modification and improve the planter according to the feedback information On farm demonstration/ Experiment set up in the farmer's field with potato planting anufacturer/operator training	Completed Already demonstrated Already trained
4.	Refine potato planter prototype making Final workshop among with researcher, policy planner, manufacturer, potato growers	Fabrication prototype of potato planter completed Workshop on "Dissemination of low cost potato planter" was conducted on April 2014; immediately after potato harvesting season.
5.	Data processing and final report writing	Final report to be completed on June 2014

6. Budgetary Information: i) Total Approved Budget Tk.11, 92,000/-; ii) Fund released Tk. 9, 93,000/-; Fund spent Tk. 9,66,085/-.

7. Persons interviewed: Aminur Rahman, a farmer, Date of Monitoring: 13 February to 15 February 2014

8. Constraints & Suggestions:

Constraints	Suggestions
Purchase price of potato planter high	Subsidize rate can attract users
Extension work, popularity works limited	More demo, pilot project necessary for popularize potato planter
Potato harvester is necessary side by side potato planter	Development and expansion work of potato harvester needed in the farmers field
Lack awareness on mechanical potato planting	More trainings, more demo, seminar can be organized

9. Comments of the Monitoring Team: i) Neighbors showed interest to adopt the technology; ii) Initial cost is somewhat high, so instead of single farmer it should be utilized by community basis or farmers should

operated in rental basis; iii) Research institute should contact with manufacturer for multiplication of the potato planter.

Soil water and nitrogen management for sustainable crop production in drought prone areas of Bangladesh using nuclear techniques

1. Objectives: i) To improve nitrogen use efficiency in crop with a view to minimum water use, ii) To recommend economic and environment friendly nitrogen management for wheat-rice cropping pattern.

2. Implementing Agency & Division/Section: Soil Science Division, BINA, BAU Campus, Mymensingh.

3. Name & Designation of the Program Leader with address: Hafez Md. Ekram ul Haque, PSO, Soil Science Division.

4. Implementation Locations: High Barind Tract, Experimental site: Farmers Field, Sarail, Godagari, Rajshahi.

5. Major Activities:

Sl. No.	Planned Activities	Implementation Status
1.	Experiment 1: Isotope aided studies of different irrigation and nitrogen levels on the growth and yield of wheat (1 st Cycle)	Completed in 2012
2.	Experiment 2: Study the use efficiency of soil water and nitrogen for sustainable wheat production in drought prone areas of Bangladesh (1 st Cycle)	Completed in 2012
3.	Experiment 3: Isotope aided studies of different irrigation and nitrogen levels on the growth and yield of wheat (2 nd Cycle)	Completed in 2013
4.	Experiment 2: Study the use efficiency of soil water and nitrogen for sustainable wheat production in drought prone areas of Bangladesh (2 nd Cycle)	Completed in 2013
5.	Experiment 5: Study on Soil water and N use efficiency for wheat production in drought prone area of Bangladesh (3rd Cycle)	On going
6.	Experiment 6: Study on Nitrogen use efficiency for wheat production at Barind area of Bangladesh	On going

6. Budgetary Information: i) Total Approved Budget: Tk. 12,00,000/-; ii) Fund released at that time: Tk. 10,00,000/-; iii) Fund spent at that time: Tk. 9,01,772/.

7. Name of the persons interviewed: Hafez Mohammad Ekram ul Haque, PSO & Chief Investigator; Md. Elias Hossain, SO & Co-Investigator; Md. Arikul Islam, Farmer.

8. Suggestions: Fund should be released timely.

9. Comments of Monitoring Team: i) Field trials placed properly with well labeled Signboard; ii) Significant difference was observed in the field among different treatments; iii) The Monitoring Team was highly satisfied by observing the overall management activities of the program.

Improvement of gladiolus quality and its adaptation

1. Objectives: i) To improve flower and corm quality; ii) To disseminate BARI released gladiolus varieties; iii) To increase yield per unit area and farmers income.

2. Implementing Agency & Division/Section: Floriculture Division, HRC, BARI, Joydebpur, Gazipur-1701.

3. Name & Designation of the Program Leader with address: Dr. Kabita Anzu-Man-Ara, PSO, Floriculture Division, HRC, BARI, Joydebpur, Gazipur.

4. Implementation Locations: Horticulture Research Centre (HRC), Joydebpur, Gazipur and/near to other horticultural/ agricultural research station of BARI in different regions of Bangladesh such as Jainna bazar (Sreepur), Godkhali (Jessore), Sonatola (Bogra) and Najirhat, Burirhat (Rangpur).

5. Major Activities:

Planned Activities	Implementation Status
Adaptive trial of different varieties of Gladiolus at farmers field	BARI Gladiolus-1, 2 & 3 were demonstrated

Selection of site and farmers	The farmers and site were selected properly
Setting up demonstration trial	Trial was set up on 20-30 Oct. 2013 at Sonatola, Bogra
Cultural practices	The trial was set on 250sq.m land and all cultural practices were done timely
Data collection	Data were collected on yield & yield contributing characters
Monitoring	Regular visit were performed by scientists & suggestions were given as per requirement
Farmer's Reaction	Farmers were impressed by observing the overall performance of BARI released Gladiolus varieties. They are very much interested to grow Gladiolus in more area for higher economic return
Reporting	The detailed results would be stated in the final report very soon

6. Budgetary Information: i) Total Approved Budget: Tk. 2,80,000/-; ii) Fund released: Tk. 1,40,000/-; iii) Fund spent: Tk. 1,14,924/-.

7. Name of the persons interviewed: Dr. Kabita Anzu-Man-Ara, PSO, HRC, BARI; Md. Shakiluzzaman, Farmer, Sujayetpur, Sonatola, Bogra; Md. Shahidul Islam, Farmer, Sujayetpur, Sonatola, Bogra.

8. Constraints: Temperature control to a certain degree is required for corm preservation, the facilities for which are not available at farmers level. Suggestions: Commercially entrepreneurship is required for preservation of corm. Conventional method of corm preservation causes 30-40 loss.

Monitoring Report Presentation by Team- 8

Three projects monitored implementation status of the Core Sub-Projects conducted by different research institute and university like BARI, BINA and BAU. The team leader and members were Dr. Paresch Chandra Golder, MD (P&E), BARC; (Team Leader); Dr. Shah Md. Ziqrul Haq Chowdhury, CSO, Livestock Division, BARC (Member) and Mr. Rafiq Mustofa Kamal, PDO, BARC (Member). Following Projects were monitored by the team members on 16 to 18 February 2014.

Projects Monitored by the Team-8

Sl. No.	Title	Implementing Institutes	Name of PI's
1.	Improvement of gladiolus quality and its adaptation	Floriculture Division, HRC, BARI, Joydebpur, Gazipur-1701	Dr. Kabita Anzu-Man-Ara, PSO, Floriculture Division, HRC, BARI
2.	Isolation, Identification and characterization of the etiological agent of infectious coryza in chicken and development of its effective remedial measures	Dept. of Microbiology, HSTU, Dinajpur, Dept. of Microbiology and Hygiene, BAU	Prof. Dr. Md. Mostafizer Rahman, Chairman, Dept. of Microbiology, HSTU
3.	Development of short duration high yielding and high yielding boro rice varieties through induced mutation	Plant Breeding Division, BINA	Dr. Md. Abul Kalam Azad, CSO (C.C.), Plant Breeding Division, BINA

Improvement of gladiolus quality and its adaptation

1. Objectives: i) To improve flower and corm quality; ii) To disseminate BARI released gladiolus varieties, iii) To increase yield per unit area and farmers income.

2. Implementing Agency & Division/Section: Floriculture Division, HRC, BARI, Joydebpur, Gazipur.

3. Name & Designation of the Program Leader with address: Dr. Kabita Anzu-Man-Ara, PSO, Floriculture Division, HRC, BARI, Gazipur.

4. Implementation Locations: Horticultural/Agril. Research Station of BARI: HRC, Joydebpur, Gazipur, Jannabazar (Sreepur), Godkhali (Jessore), Sonatola (Bogra) and Najirhat, Burirhat (Rangpur).

5. Major Activities:

Planned Activities	Implementation Status
On-Farm Trial: Adaptation trial of different varieties of gladiolus at farmers field at different places	Monitoring Team-8 monitored the Burirhat (Rangpur) site where BARI Gladiolus-1, 3, 5 were used in 2 villages of Abhirum, Rangpur Sadar and Gopinathpur, Badarganj, Rangpur. Gladiolus planted on 10-12 Oct. 2013 in 4-6 decimals lands (as demonstration plots) at farmer's fields. The crop condition was found satisfactory and most of the flowers were harvested.

6. Budgetary Information: Total Approved Budget: Tk. 2,80,000/-; Fund released: Tk. 140,000/-; Fund spent: Tk. 1,14,924/-.

7. Name of the persons interviewed: Dr. Kabita Anzu-Man-Ara, and a farmer.

8. Observation by the team: The team found the Gladiolus plants in the plots where almost all flowers were harvested. Farmer's got net profit of Tk. 7000.00 to Tk. 8000.00 with BARI Gladiolus 1, 3, 5 within about 4 months using 4-6 decimals of their lands.

Isolation, Identification and characterization of the etiological agent of infectious coryza in chicken and development of its effective remedial measures

1. Objectives: i) To isolate & identify the etiological agent of Infectious Coryza from bird suspected to be infected/field cases based on age, sex, breed, temporal and spatial differences; ii) To characterize the isolated etiological agent of Infectious Coryza by using cultural, biochemical, serological, antibiogram and molecular techniques, and iii) To develop and validate the vaccine candidate from the field isolate to control infectious coryza in chicken.

2. Implementing Agency & Division/Section: Dept. of Microbiology, HSTU, Dinajpur & Dept. of Microbiology and Hygiene, BAU

3. Name & Designation of the Program Leader with address: Prof. Dr. Md. Mostafizer Rahman, Chairman, Dept. of Microbiology, HSTU.

4. Implementation Locations: Lab. of Microbiology, Dept. of Microbiology, HSTU, Dinajpur

Date of Monitoring: 16 February to 18 February 2014.

5. Major Activities:

Planned Activities	Implementation Status
Collection of samples	122 samples were collected. Out of these 56, 44 and 22 samples were collected respectively from Dinajpur, Thakurgaon and Rangpur
Isolation of organism by observing morphological, cultural & biochemical characteristics	58 and 57 samples were found positive by observing morphological and cultural characteristics. On Biochemical test 56, 55, 53, 57, 56 and 58 samples were found positive respectively by TSI agar slant reaction, MIU, Indole test, MR test, H ₂ S Production, VP test.
Determination of efficacy of drug against the isolated organism	All <i>Haemophilus paragallinarum</i> positive samples (58) were highly sensitive to Amoxycillin, Gentamycin and Oxytetracycline; moderately sensitive to Erythromycin, Sulphonamide and Trimethoprim; and resistant to Tylosin and Norfloxacin.
Isolation of pure isolates by serological and molecular techniques	DNA extraction was done and PCR technique was on going.
Vaccine development	Yet to be done

6. Budgetary Information: Total Approved Budget: Tk. 6,00,000/-; Fund released: Tk. 4,35,000/-;

Fund spent: Tk. 4,35,000/-.

7. Constraints: Procurement of molecular reagents was delayed, for which the PCR could not be completed yet to confirm the organism. Suggestion: PCR should be completed as soon as possible. Because, without positive PCR the results of getting the organism will not be finally confirmed.

8. Observation by the team: The BARC monitoring team visited the PI's laboratory where the research works have been done. The team was satisfied with the facilities of the laboratory. The team was worried that the PCR to confirm the organism has yet to be completed.

Development of short duration high yielding and high yielding boro rice varieties through induced mutation

1. Objectives: i) To develop boro rice variety (s) with yield potential of 8.0-8.5 t/ha and 155-160 days

maturity; ii) To develop short duration (115-120 days) boro rice variety(s) with 6.0-6.5 t/ha yield that can be transplanted after harvest of high yielding mustard/rapeseeds variety.

2. Implementing Agency & Division/Section: Plant Breeding Division, BINA.

3. Name & Designation of the Program Leader with address: Dr. Md. Abul Kalam Azad, CSO (C.C.), Plant Breeding Division, BINA.

4. Implementation Locations: BINA Farm, Mymensingh, BINA sub-sector farms at Magura, Rangpur and Barisal, and Farmer's field at Mymensingh, Rangpur, Magura and Barisal. Date of Monitoring: 16 February to 18 February 2014.

5. Major Activities:

Planned Activities	Implementation Status
Zonal yield trial with M5 high yielding mutant lines of boro rice	
Selection and preparation of land and raising seedlings of short duration boro rice	Seeds of the short duration high yielding mutants, RM (2)-40 (C)-1-1-10) together with the parent variety, BRRI dhan29, were sown on 01 January 2014 and transplanted on 12 February 2014 at Rangpur Substation farm. The another experiment in the farmer's field was transplanted on 13 February 2014.
Transplanting of seedlings and intercultural operations	
Harvesting	-

6. Budgetary Information: Total Approved Budget: Tk. 4,00,000/- (2013-14); Fund released: Tk. 2,00,000/-; Fund spent (till 21 January 2014): Tk. 1,46,843/-.

7. Observation by the team: The BARC monitoring team visited the On-station and On-farm demonstration plots in Rangpur. The On-station trial was at BINA sub-station, Rangpur with a land of 2.5 decimals, whereas the On-farm trial was at farmer's field of village Pokkifandha of Rangpur Sadar (Farmer- Md. Mokbul Hossain) with a land of about 4.75 decimals. The team found the transplanted Boro rice at both On-station and On-farm demonstration plots that supposed to be harvested in May 2014.



On-Station Trial of RM (2)-40 (C)-1-1-10 at BINA Sub-station, Rangpur

Monitoring Report Presentation by Team- 9

Four projects monitored implementation status of the Core Sub-Projects conducted by different research institute and university like BARI, BINA and BAU. The team leader and members were Dr. Sultan

Ahmed, Member Director (NRM), BARC; (Team Leader); Dil Afroz, Director (AIC), BARC (Member) and Muhammad Mahbubul Hassan, Senior Asst.

Director. (Budget), BARC (Member). Following Projects were monitored by the team members on 16 to 18 February 2014:

Projects Monitored by the Team-9

Sl. No.	Title	Implementing Institutes	Name of PI's
1.	Development of short duration high yielding and high yielding boro rice varieties through induced mutation	BINA Farm- Mymensingh, Magura, Rangpur & Barisal Farmer's field - Mymensingh, Rangpur, Magura & Barisal	Dr. Md. Abul Kalam Azad, Chief Scientific Officer (Current Charge), Plant Breeding Division, Bangladesh Institute of Nuclear Agriculture (BINA)
2.	Adaptation of matured Technologies on Crop variety in Southern Char lands of Bangladesh	Regional Agricultural Research Station, BARI, Rahmatpur, Barisal.	Dr. Md. Shahidul Islam Khan, Senior Scientific Officer, Regional Agricultural Research Station, Bangladesh Agricultural Research Institute, Rahmatpur, Barisal
3.	Improvement of jute based cropping pattern & jute seed production techniques in southern areas of Bangladesh	Jute Farming Systems Division, Bangladesh Jute Research Institute	Mohammad Hussain, Director (Agriculture), Bangladesh Jute Research Institute (BJRI)
4.	Fine tuning and demonstration of sustainable live food culture technology to produce low cost fish and prawn in coastal pond	Department of Aquaculture, Patuakhali Science and Technology University, Dumki, Patuakhali	Dr. Md. Lokman Ali, Associate Professor and Chairman, Department of Aquaculture, Patuakhali Science & Technology University

Development of short duration high yielding and high yielding boro rice varieties through induced mutation

1. Objectives: i) To develop boro rice variety(s) with yield potential of 8.0-8.5 t/ha and 155-160 days maturity; ii) To develop short duration (115-120 days) boro rice variety(s) with 6.0-6.5 t/ha yield that can be transplanted after harvest of high yielding mustard/rapeseeds variety.

2. Implementing Agency & Division/Section: Plant Breeding Division, Bangladesh Institute of Nuclear Agriculture (BINA).

3. Name & Designation of the Program Leader with address: Dr. Md. Abul Kalam Azad, Chief Scientific Officer (Current Charge), Plant Breeding Division, Bangladesh Institute of Nuclear Agriculture (BINA)

4. Implementation Locations: BINA Farm-Mymensingh, Magura, Rangpur & Barisal. Farmer's field- Mymensingh, Rangpur, Magura & Barisal.

5. Major Activities:

Sl	Planned activities	Implementation Status
A.	Field evaluation of short duration mutant lines for release	
i.	Selection and preparation of land and raising seedlings of short duration boro rice	This experiment was carried out during 2012-13 and the late transplanting potential, short duration and high yielding boro and
ii.	Transplanting of seedlings and intercultural operations	

iii.	Harvesting	T.aman rice variety Binadahan-14 has been released.
iv.	Training/field days	
B.	Zonal yield trial with M ₈ high yielding mutant lines of boro rice	
i.	Selection and preparation of land and raising seedlings of short duration boro rice	Seeds of the short duration high yielding mutants, RM (2)-40(C)-1-1-10 together with the parent variety, BRRI dhan29, were sown during 02 to 20 December, 2013 and transplanted during 09 to 31 January, 2014 at Mymensing, Magura and Barishal both at on-station and at farmer's field. At Rangpur due to severe cool weather seeds have been sown on 20 January & not yet transplanted.
ii.	Transplanting of seedlings and intercultural operations	
iii.	Harvesting	

6. Budgetary Information: Total Approved Budget: Tk 4,00,000.00; Fund released: Tk 2,00,000.00; Fund spent: Tk 93,528.00.

7. Observation by the Monitoring Team: PI is living in Mymensing and the project is implemented in Barisal; Site is not properly selected and prepared in sub-station farm at Barisal; Site in farmer's field is okay.

8. Name of the persons interviewed: Dr. Md. Abul Kalam Azad, Chief Scientific Officer (Current Charge), Plant Breeding Division, Bangladesh Institute of Nuclear Agriculture (BINA); Date of Monitoring: 16 February to 18 February 2014



The team members visited the experimental field

Adaptation of matured Technologies on Crop variety in Southern Char lands of Bangladesh

1. Objectives: i) To disseminate modern agricultural technologies in char areas, ii) To utilize the unfavorable char lands during Rabi, and iii) To develop new cropping pattern, management practices suitable for char land.

2. Implementing Agency & Division/Section: Regional Agricultural Research Station, BARI, Rahmatpur, Barisal.

3. Name & Designation of the Program Leader with address: Dr. Md. Shahidul Islam Khan, Senior Scientific Officer, Regional Agricultural Research Station, Bangladesh Agricultural Research Institute, Rahmatpur, Barisal.

4. Implementation Locations: Barisal and Bhola; Date of Monitoring: 16 February to 18 February 2014:

5. Major Activities:

Planned Activities	Implementation Status
A base line survey Adaptive trials on wheat, lentil (relay and sole), Kaon, Gardenpea, Mungbean and sesame during 2011-12	<ol style="list-style-type: none"> 1. Adaptive trials on wheat, kaon and garden pea was done successfully and gave higher yield over traditional relay lentil with T. aman. 2. Wheat varieties gave about 3.5 t/ha and farmers seems it a prominent crop for char land 3. Kaon husking and garden pea marketing is a problem in the char area though these crops gave higher yield but farmers showed their less interest about them. 4. Mungbean and sesame was damaged due to early inundation. So these crops are treated as chance crop if inundation is not occurring early.
Repetition of adaptive trials on wheat, lentil (relay and sole), Kaon, Gardenpea along with new adaptive trials on Mustard, Soybean during 2012-13	<ol style="list-style-type: none"> 1. To adopt mustard local T.aman varieties cultivated in char lands should be replaced by short duration HYV 2. Wheat varieties gave higher yield and return over other crops in char land
Up-scaling of better perform wheat variety in char area during 2013-14	<ol style="list-style-type: none"> 1. About 12 acres char lands are under this program in charlands of Laharhat, Barisal. 2. Due to unavoidable situation this program could not continue in Bhola this year.

6. Budgetary Information: Total Approved Budget: Tk 7,50,000/-; Fund released: Tk 6,25,000/-; Fund spent: Tk 5,92,528/-.

7. Observation by the Monitoring Team: Overall project performance is good; Seed sowing machine is used for cultivation; Communication/transport problem; Farmers are motivated; Increase cultivable areas in char lands.

8. Constraintss: Delay planting and delay harvesting of T.Aman; High depth of flooding during monsoon (Jyly-August); Unavailability of improved varieties of different crops; Lack of agricultural implements; Early inundation in late rabi season; T.Aus damaged at panicle initiation stage due to high pressure of flood water; Higher weed infestation; Severe birds attack in early T.aman variety at harvesting stage; Free cattle raring; Troublesome transport system; OM Supply-Improve soil physical, chemical, biological environment; Right nutrient management on the basis of Soil Test Bases Value; Crop rotation during dry-season; Short duration T.aman and rabi varieties should be cultivated to scape early inundation problem; Improved varieties and modern agricultural machineries should be available in the area.

Improvement of jute based cropping pattern & jute seed production techniques in southern areas of Bangladesh

1. Objectives: i) To identify suitable variety of jute (capsularis) and kenaf for seed production at farm level in southern area To utilize the unfavorable char lands during Rabi; ii) To develop jute based cropping pattern for potential use of land of the area; iii) To identify jute and jute seed production constraints in the area; and v) To find out the appropriate technique for jute seed production.

2. Implementing Agency & Division/Section: Jute Farming Systems Division, Bangladesh Jute Research Institute.

3. Name & Designation of the Program Leader with address: Mohammad Hussain, Director (Agriculture), Bangladesh Jute Research Institute (BJRI).

4. Implementation Locations: Patuakhali - Kalapara & Dumki, Barguna – Amtoli, Date of Monitoring: 16 February to 18 February 2014.

5. Major Activities:

Planned Activities	Implementation status
Number of demonstrations	There are 12 (twelve) demonstrations plot of T.Aman rice were conducted at three locations during kharif-2 season and 03 (three) demonstrations plot of late jute with winter vegetables.
Sites & Farmers Selection	Already Completed
Land Preparation and sowing for Kharif -2 and Rabi crops	<ul style="list-style-type: none"> Experiments on "Late jute seed production with winter vegetables" has already been conducted at two locations like Pakhimara jute Research Sub-station, Charghat under Amtali Upazilla. Incase of jute based cropping pattern experiment jute-T.aman- mungbean, T.aman rice has already been harvested and at present mungbean crop already sown in 1.5 ha land at the same locations.

6. Budgetary Information: Total Approved Budget : Tk - 1,50,000/-; Fund released: Tk- 1,50,000/-; Fund spent: Tk - 1,33,389/-.

7. Observation by the monitoring team: Overall project performance is good. Cropping pattern suggested in the project is appreciated by the farmers. A shortage of supervisory manpower was noticed in the project.

8. Constraints: Insufficient allocation and delay in release of funds. Late and heavy rainfall during last monsoon. Devasting cyclone “Mohashen” damaged Jute fibre crop during last season.



Scintist discussing with farmers

Fine tuning and demonstration of sustainable live food culture technology to produce low cost fish and prawn in coastal pond

1. Objectives: i) To develop a sustainable and commercially viable live food culture technology; ii) To increase the yield of carp fish through increase the production of live food; iii) To increase the yield of prawn in improved extensive culture; iv) To reduce the production cost of fish and prawn; and v) To on farm trail of the technology among costal fish farmers.

2. Implementing Agency & Division/Section: Department of Aquaculture, Patuakhali Science and Technology University, Dumki, Patuakhali.

3. Name & Designation of the Program Leader with address: Dr. Md. Lokman Ali, Associate Professor and Chairman, Department of Aquaculture, Patuakhali Science & Technology University.

4. Implementation Locations: Itbaria, Kalapara, Patuakhali and Patuakhali Science and Technology University. Date of Monitoring: 16 February to 18 February 2014.

5. Major Activities

Planned Activities	Implementation status
Use of natural zooplankton to produce freshwater prawn juvenile	Carried at Kalapara upazila, completed
Impact of fertilizer on mass production zooplankton in coastal region	This experiment is going on at PSTU pond complex with 12 pond
Impact of live food and artificial diet on fish production in coastal Pond	Experiment has been started from March, 2014

6. Budgetary Information: Total Approved Budget: Tk. 3,00,000/-; Fund released: Tk. 1,50,000/-; Fund spent: Tk. 1,48,350/-.

7. Observation by the monitoring team: Overall project performance is very good. Seems to be a model of Public-Private Partnership.

activities of National Agricultural Technology Project-DLS Unit.

Project Development/ Project Financing

Research projects under funding from NATP-SPGR

LIVESTOCK

The Livestock Division of BARC is involved in organizing and managing various research and other related activities for developing the livestock sector in Bangladesh. This division is working to achieve the goal of improving nutritional status of the general mass through cost-effective livestock production for increased supply of animal origin food, supporting increased crop production through providing healthy draft animals and biological manure, and helping the rural poor in the generation of employment, income and fuel supply through profitable livestock rearing.

To carry out the mandated responsibilities of BARC and to full-fill the national need the division is entrusted with the duties of planning, reviewing, prioritizing, approving, monitoring, evaluation, supervision and coordination of the livestock research programs implemented by the relevant NARS institution and other institutions including universities, Department of Livestock Services (DLS) and NGOs. The division is providing training and research support to the NARS institution, DLS, relevant faculties of various educational institutions and NGOs. The division is imparting policy support to the relevant NARS institutes and extension agencies. The division is arranging, conducting and participating in training, meetings, and seminars/workshops. The division is also engaged to support national avian influenza/bird flue prevention and control programs, to recruit scientists/officers in NARS institutes, to support researches of NARS institutes, and to support different

There were a total of 9 on-going SPGR research sub-projects from Bangladesh Livestock Research Institute (BLRI), Bangladesh Agricultural University (BAU) and Chittagong Veterinary and Animal Sciences University (CVASU). These research projects developed with the leadership/co-ordination of Livestock Division, BARC, were funded under SPGR, PIU-BARC, National Agricultural Technology Project, Phase-1, BARC. Livestock Division, BARC was directly involved for overall coordination, supervision and regular monitoring of these sub-project activities. Out of these 9 sub-projects, one sub-project was coordinated with the involvement of BAU, CVASU and BARC (coordinating unit), and another sub-project was coordinated with the involvement of BAU, BLRI and BARC (coordinating unit). All these sub-projects were completed. Fund release and brief progress of these projects are given below:

Study on milk urea nitrogen (MUN) for improvement of dietary nutrition of dairy cows in Bangladesh: Milk Urea Nitrogen (MUN), a fraction of milk protein that is derived from Blood Urea Nitrogen (BUN), may be a useful tool that may help monitoring of any change required in the feeding and management of a herd. The database on milk nutrient constituents of local, crossbred cows at on farm and on station trial was formulated. The protocol and database of milk urea nitrogen (MUN) and blood urea nitrogen (BUN) were developed which were almost absent in Bangladesh. It was reported that the MUN value at on farm ranges 22-39 mg/dl which represents inappropriate ration supplement to the dairy cows. The MUN value at on

station ranges 17-19 mg/dl providing the required rumen degradable protein (RDP) level of Agricultural Research Council (ARC) (574g/d) or 25% reduced amount of RDP (446g/d) than requirement-the values are similar to the standard MUN value. A total of 720 farmers were involved directly or indirectly from 4 different regions (Rangpur, Sirajgonj, Jessore & Noakhali) and briefly informed them about the activities & benefits of the project.



Local cow



Crossbred cow



Milk sample

The sub-project was completed and project completion report were prepared and submitted to PIU-BARC.

Development of an effective PPR vaccine seed from local isolate and its molecular characterization:

BAU part: The present study was aimed to isolate and characterize the prevalent *peste des petites ruminant* virus field strains of Bangladesh, development of a suitable vaccine seed and diagnostic methods. So far, the project has the following achievements: PPR virus isolates BD/PPR/08; BD/PPR/Dhaka 1/10 completed 65 passages (Fig. 1), ± 70 passages will be required for full attenuation of the virus. Fifteen PPR virus isolates characterized from the field available in the repository which can be used for further research, production of antigen and antibodies etc. Twenty partial and 1 full length gene sequences of PPR virus submitted in GenBank (Table 1). Molecular methods for the detection of F and N genes developed. The developed methods were validated by joint IAEA/FAO laboratory, Vienna, Austria. The laboratory has been certified with 100% proficiency by the said agency (certificate awarded).

PPR virus sequences submitted in GenBank

Isolate Name	GenBank Accession No	
	N gene	F gene
BD/PPR/2008*	JF276436	HQ898003
BD/PPR/Dhaka-1/10*	JQ612706	JX094437
BD/PPR/Narayangonj/09	JQ612707	JX094440
BD/PPR/Dhaka-2/09*	JQ612708	JX094438
BD/PPR/Mymensingh/10	JQ612709	JX094439
BD/PPR/Netrokona-1/2011	JX220409	JX220413
BD/PPR/Netrokona-2/2011	JX220410	JX220414
BD/PPR/Netrokona-1/2012	JX220411	
BD/PPR/Netrokona-2/2012	JX220412	JX220415
BD/PPR/Narayangonj-1/2011	JX220416	
BD/PPR/Narayangonj-2/2011	JF276436	
BD/PPR/BAU/Sheep/09		JX094436

BLRI part:

Peste des Petits Ruminants (PPR) is an acute, highly contagious viral disease of goat and sheep. The aim of the present study was to isolate and characterize the

circulating *Peste des Petits Ruminants* viruses. So far, 458 samples (104 tissues & swabs and 282 serum samples from goat and 72 serum samples from sheep) were collected from different regions of the country and 118 (62%) was found positive for PPR. Animal inoculation test in goats done with 50th passaged viruses from BAU showed that the viruses were not fully attenuated and further ± 20 more passages will be required for full attenuation of the virus. Sequencing of the five selected isolates was partially done that formed the following phylogenetic tree. The virus circulating in 2013 were found 98 to 100 percent identical. Phylogenetically all Bangladeshi isolates clustered under lineage IV.

Studies of the Quantitative Trait Loci (QTL) of economic traits in Black Bengal goat: This experiment was carried out in Natore, Bandarban Hill district and Bangladesh Agricultural University, Mymensingh to produce breeding stock of Black Bengal goat and to detect Quantitative Traits Loci (QTL) of economic traits. Two flocks of goats were reared through contact farmers in Natore and Bandarban Hill district respectively. Growth rate, Carcass yield, meat quality, litter size and kidding interval were the traits of interest for QTL study. Six hundred thirty eight pure Black Bengal kids, 304 cross bred kids and 24 back cross kids could be produced in Natore. Two hundred sixty eight Black Bengal kids could be produced in Bandarban Hill district. Average growth rate of kids up to weaning was 57.06 ± 0.89 and 67.38 ± 1.50 g/d for Black Bengal and crossbred kids respectively in Natore and 92.99 ± 1.53 g/d for Black Bengal kids in Bandarban. Litter size was 2.06 and 1.67 for Black Bengal does in Natore and Bandarban Hill district respectively. Kidding interval was 209 and 226 days for Black Bengal does in Natore and Bandarban Hill district respectively. Dressing percent was $48.18 \pm 0.61\%$, $51.84 \pm 0.31\%$ and $49.18 \pm 0.51\%$ for yearling Black Bengal bucks in Natore, yearling Black Bengal bucks in Bandarban Hill district and yearling crossbred bucks in Natore respectively. Husbandry of goat rearing was also improved resulting in increased number of goat per family. DNA was extracted from foundation stocks and subsequent generations of goat in Natore. Forty microsatellite markers of variable length was found suitable for the experimental populations and amplified through PCR using the extracted DNA. Sequencing analysis and phenotypic data are in progress towards detection of QTL. Existing molecular genetics laboratory of the department was modernized through procurements of essential

equipment. A Number farmer's volunteer, 3 MS students and one Ph.D. students have been produced through this project.



Crossbred doe & Backcross kid



BAUBro-white



BAU-Bro color

Approaches to develop broiler sire and dam lines from available genetic resources: A selection study was undertaken with 1670 one-day-old male line white (MLW), male line colour (MLC), female line white (FLW) and female line colour (FLC) chickens as foundation stock to develop broiler sire and dam lines for the production of day-old broiler chicks. The birds were reared on litter floor up to 18 wks of age and then transferred to individual laying cages. The male lines were selected on 5th week's body weight, while female lines were selected at 35 weeks on index value. The experiment was continued up to 35 weeks of age. The mature body weight was 3486 ± 112 ; 2080 ± 105 ; 1579 ± 20 ; 1556 ± 40 and 2280 g in MLW, MLC, FLC, FLW and FLW₂ respectively. The male lines came to sexual maturity at 24-25 weeks and the female lines at 23-26 weeks of age at G₃. The broiler chicks produced through line crosses of MLW \times FLW₂ (BAU-Bro-white) attained the highest live weight, 2029g with FCR 1.67, while the colour strain (BAU-Bro color) from MLC(Bl.) \times MLC(Br.) attained 1210g with FCR 1.77 at 6 weeks. The liveability was 99-100% with high dressing meat yield, 74-75% in both white and colour strains. The evolved broiler parents performed better and have lower production cost than standard breeder. The developed broiler parents and broiler chicks can be disseminated to farmer's level for commercial production.

Production of HYV vis-a-vis Indigenous seed bulls to support Smallholder dairying in Bangladesh: A benchmark survey was conducted in the project area which revealed the status of livestock (mainly cattle) in respect of available cattle genetic resources, breeding system, quality of breeding services, their production, reproduction, health status, management system and marketing system and identified elite (most productive) dairy cows and their owner farmers in the project area. Average milk yield of Deshi and crossbred cows were 1.72 ± 0.80 and 6.65 ± 5.05 liters per day respectively whereas lactation period and dry period were respectively as 243.98 ± 113.13 and 92.37 ± 63.14 days for crossbred, 249.69 ± 106.93 and 96.58 ± 32.06 days for Deshi cows. An agreement was reached with the farmers to participate in a seed bull production program in a contractual procedure. Thereafter, two farmers' cooperatives were formed with farmer groups in two different corners of the project area, Bade Kolpa and Chala Kandi. A Farmers' Catalogue was prepared with photographs of 80 registered farmers and their cows. Door to door identification of around 109 high producing elite cows and heifers (mother of future seed

bulls) of various HYV and Deshi genotype, their registration with unique identification system using ear tags and neck bands, on-ward individual pedigree and performance recording using Herd Book and after checking the data were entered in the developed databases. Registered elite cows / heifers were bred with semen of superior known dairy merit on priority basis and registered animals were tested for major diseases e.g. mastitis, TB, brucellosis and parasitic infestation on regular basis. Farmers training, routine vaccination and deworming of registered animals and their progeny calves and regular monitoring of field data (parent and progeny) collection were carried out. Blood, feces and milk of the registered animals were routinely tested for investigating their health status where milk borne disease was noticed to be the major problem. Potential male seed calves with good dairy genetic merit and mother's reproductive profile, test-day milk records of registered cows and body weight records of their progeny, close monitoring of their health status were critically recorded and maintained which were later evaluated to reveal their breeding values through mixed model procedure and profiles were placed before a "Seed Bull Certification Committee" to declare best seed bulls for use in the dairy industry.

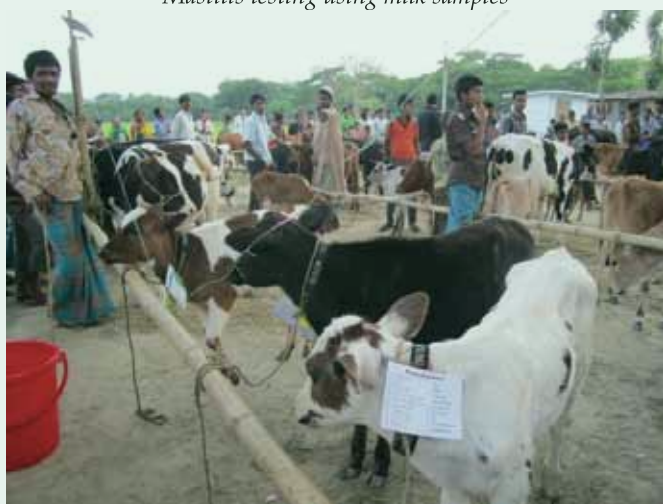
Average birth weight of 75% Holstein Friesian (HF), 62.50% HF and 50% HF calves were 26.52 ± 0.75 , 24.37 ± 0.62 and 25.63 ± 0.75 kg. Average body weight of 75% Holstein Friesian (HF) genotype was higher at weaning (168.82 ± 28.76 kg) than 50% HF (128.71 ± 23.09 kg) and 62.50% HF (138.98 ± 21.65 kg). Average daily gain (ADG) of male and female calves from birth to weaning was 487.59 ± 12.08 g/day and 496.05 ± 16.79 g/day. Average survival rate of crossbred male calves was 96.38% and female calves was 98.79% and survival rates of 75% HF, 62.5% HF and 50% HF crossbred calves were 96.38%, 98.79% and 100% respectively.

To create awareness, dissemination of need-based information among scientific community and other stakeholders including farmers, two "Seed Calf Rally" were held in the project area. The present project has already created very good awareness, knowledge and voice of farmers, disseminated need-based information among scientific community, government authority, practitioners, cattle breeding service providers and other stakeholders including farmers, through published reports, bulletins, catalogues, National Workshop, Seed Calf Rally etc. A total of 24 (16 plus 8) such young seed bulls in two batches were certified and declared

suitable for breeding purposes by the Seed Certification Committee and information catalogue on the said two batches of bulls have already been passed on to the cattle breeding service providers of the country for necessary action. Finally, replications of this pilot work in collaboration with cattle breeding service providers elsewhere in Bangladesh is envisaged.



Mastitis testing using milk samples



Young seed bulls in the Calf Rally

A Coordinated project on the Surveillance of Important Infectious, Zoonotic and Emerging Diseases of Livestock and poultry in Bangladesh: BAU Part:

Considering the importance of the availability of deadly infectious diseases more than 2000 animals were examined and more than 850 samples were collected that were analyzed. The technologies adopted or designed were Histopathology, PCR, RT-PCR, Real Time RT-PCR, ELISA, special histopathological and smear staining techniques, Bacteriology, Serology and Routine Necropsy. Results of this study showed that the cattle were infected with

FMD viral serotypes O, A and Asia-1, and Serotype "0" constituted the higher incidence (more than 80%). FMDV serotypes were further characterized. Out of a total of 696 cattle tested using intradermal tuberculin test, 23 cattle were positive to tuberculin. Cattle were infected with human TB (20%). Leishmanial (Kal-azar) protozoa were identified from cattle, goat, dogs and jackals, and these animals could be acting as symptomless carrier of Kal-azar. The protozoa were further characterized. Results of Rose Bengal Plate Test and ELISA on 190 cattle sample indicated *Brucella* infectivity in 2.63% and 1.05% cases respectively. Results of uniplex and multiplex PCR showed that cattle in Madhupur (Tangail) and Sirajgonj were infected and co-infected with *Babesia bovis*, *Anaplasma marginale* and *Theileria annulata*. The epidemic of duck mortality in the haor areas was investigated and about 75% dead ducks were found to be carried or infected with *Duck anatepestifer* (Duck septicemia). Ducks in these areas were also infected with H5 type of avian influenza viruses. This study also adopt protocols for rapid and confirmatory diagnosis of Avian influenza, Mareks disease, Schistosomiasis, Canine distemper, Anthrax, Avian TB in chicken *etc.* The poultry breeder stock were found to infect with both virulent and low virulent serotypes of Mareks disease virus. Avian influenza viral genomic content were detected in Golden Jackles. A data based surveillance was done with the data of three consecutive years (2010, 2011 and 2012) collected from the hospital cases of DLS and results were analyzed. All those would help in early detection of the deadly infectious diseases and as well as future prevention and control of those diseases both in animals and human.



Surveillance Team is Preparing to collect sample

CVASU Part:

Both active and passive surveillance protocols were developed and with these data and/or sample collection was completed. Based on 3 years Upazilla hospital data, the month wise highest frequency of the diseases of livestock was found to be the Diarrhea occurring during November to January; FMD during February-March; and Liver fluke during April to October. The top 10 frequently occurring diseases were Liver fluke (10.66%), Diarrhoea (7.92%), Mastitis (7.42%), FMD (6.42%), Parasitic gastroenteritis (6.31%), Coccidiosis (5.5%), PPR (5.32%), ND (4.36%), Anthrax (4.19%) and BQ (3.74%). In chicken the most frequently occurring diseases were found to be ND (28%), FC (19%) and Coccidiosis (11%). In ducks the most frequently occurring diseases were Duck viral enteritis (28%), Duck viral hepatitis (17%), Diarrhoea (15%), Coccidiosis (10%) and Intestinal helminthiasis (10%). In an attempt to develop and establish highly technological diagnostic facilities Rabies was detected using RT-PCR. Phylogenetic analysis demonstrated that all the viral isolates belong to Arctic lineage of rabies virus and share a common ancestor with viruses from neighboring countries including India, Nepal, Iran and Pakistan. ILT virus in the infected samples was detected using PCR test for ICP4 gene. IB virus was detected using RT-PCR with the primers for 5' UTR (un-translated region) gene of IBV. Presence of endogenous ALV in the suspected sample was confirmed using multiplex PCR test. MS infection was confirmed using PCR of 16S rRNA gene specific for the organism. *E. coli* in the infection was also confirmed using PCR test with the primer sets for 16S rRNA gene specific for the organism. Detail studies on emerging poultry diseases like ILT, IB, AL, MS along with a prevalence study of bacterial diseases of chickens in Chittagong was conducted. To help formulating possible steps towards controlling/preventing outbreaks the risk factors of some specific diseases were also determined. Among the various bacterial diseases only Colibacillosis and Staphylococcosis were detected with prevalence rate being 48.44% and 8% respectively along with 0.9% mixed infection. In Culture sensitivity (CS) test the organisms (n=185 isolates) were found 100% sensitive to cephradine and kanamycin but 100% resistant to ampicillin, penicillin and ciprofloxacin. Staphylococcosis was found to be 100% resistant to neomycin and sensitive to doxycycline and amoxicillin. On the other hand Colibacillosis was found to be 100% sensitive to neomycin and colistin sulphate whereas, 84% resistant to amoxicillin.

Isolation and molecular characterization of egg drop syndrome (EDS-76) virus in Bangladesh:

The drop in egg production in layer birds has become a major concern in Bangladesh due to the enormous economic burden faced by the farmers. The loss incurred by poultry industry due to reduced productivity, culling and cost of medicine is considered to be often greater than loss due to mortality. With the view of the points the present study was proposed for serosurveillance of EDS and to isolate and characterize the prevalent field strains of EDS virus. For seroprevalence study total 226 sera samples were collected from 4 districts in Bangladesh and antibody titer against EDS virus were determined by HI test using the field isolates of EDS virus which were confirmed by PCR and sequencing. Highest seroprevalence was found in Gazipur (85.58%) and lowest at Tangail (66.66%) and no seropositive birds were found in Mymensingh (0.00%). On the basis of age, maximum seroprevalence was found in the flock's age between 21-40 weeks of age (45.13%). For the isolation of virus total 125 samples (abnormal eggs, uteri and cloacal swabs) were collected from layer birds of 4 districts in Bangladesh. The samples were inoculated into 11 days old duck embryo and the growth of virus was confirmed by macro and micro HA and HI tests. To confirm the isolated virus as EDS-76, the isolates were also propagated into 9 days old chicken embryo. Further the virus was characterized by PCR-RFLP, sequencing and pathogenicity test in experimental chicken. Total 3 isolates were confirmed as EDS-76 virus on the basis of slide and microplate



Collected soft shelled and shell less eggs from different layer farms

HA tests, propagation of virus in chicken embryo and PCR of EDS-76 specific Hexon gene followed by sequencing and pathogenicity test. The growth of the field isolates in chicken embryo was very weak which is the unique characteristic of EDS virus. The PCR products were subjected to PCR-RFLP to differentiate the isolates. There were no differences found among the three isolates after PCR-RFLP using restriction enzymes HindIII, XhoI, TaqAI, BstY I and BstE II. All the isolates showed similar pattern of restriction site after digestion of the PCR products with restriction enzymes. The ability of egg production in laying hen suddenly reduced to 20-60% after experimental infection with isolated virus in association with production of soft shelled or shell less eggs. Initially the color of the eggs gradually decreased brown to white followed by soft shelled and shell less eggs. Finally it may be concluded that the economic loss due to reduced egg production is more severe than the loss due to the death of birds.

Somatic cell count and bacterial characterisation as tools for diagnosis and identification of risk factors of bovine mastitis:

The major activities successfully completed were a) adoption and standardization of somatic cell count in milk samples, b) farm investigation and data collection (in cross-sectional study 399 dairy farms comprising 931 cows, and in a case-control study 117 case and 117 control farms were investigated), c) milk samples collection and bacteriological analysis, d) training of veterinarians of the project areas on Dairy Cattle Health and Production Management, and e) workshop on prevention and control of mastitis in dairy cows with the participation of learned teaching staffs, veterinarians, PhD and MS Fellows, project implementing personnel and BAURES authority. The farm-level and cow-level prevalence of subclinical mastitis (SCM) was 29.3% and 16.5%, respectively. Analysis of risk factors revealed 11 variables as potential independent farm-level risk factors for SCM.). These were absence of and insufficient sunlight, floor component (soil), dirty floor condition, no use of antiseptic after floor cleaning, infrequent floor cleaning (once or twice daily), different milking man, cows not milked sequentially, history of clinical mastitis during last year, cows not grazed during day, wipes udder and teat before milking and age of shed above 5 years, which had the strongest association with SCM with high statistical significance ($p \leq 0.05$). As cow-level risk factors, five independent risk factors for SCM were identified. These were breed, parity, cylindrical type of teat, pendulous type of udder

and history of previous clinical mastitis which had the strongest association with SCM with high statistical significance ($p < 0.05$). The major achievements are i) establishment of early diagnostic facilities of SCM in lactating dairy cows by automatic somatic cell counter, ii) major and minor pathogens causing SCM are identified and correlated with somatic cell count, iii) prevalence and risk factors of SCM in lactating dairy cows are known, iv) skills on dairy cattle health and production management of the veterinarians of project areas developed, v) mastitis control guidelines (booklet and leaflet) are formulated and distributed to the smallholder dairy farmers in the project areas.



Early detection of subclinical mastitis by using automatic somatic cell counter

Research projects under funding from Research Grant

There were a total of 2 on-going research projects from Bangladesh Agricultural University (BAU) and Haji Danesh Science and Technology University, funded under Research Grant of BARC. These research projects developed with the leadership/co-ordination of Livestock Division, BARC. Livestock Division, BARC was directly involved for overall coordination, supervision and regular monitoring of these project activities. Fund release and brief progress of these projects during the year 2013-2014 are given below.

Isolation, Identification and characterization of the etiological agent of infectious coryza in chicken and development of its effective remedial measures:

The present study was conducted for isolation, identification and characterization of *Avibacterium paragallinarum* from layer chicken in Bangladesh. The

samples (n=122) were collected from suspected birds of different areas of Rangpur division based on age, temporal and spatial differences for the isolation and identification of *Avibacterium paragallinarum* by cultural, morphological and biochemical properties. The overall prevalence of *Avibacterium paragallinarum* was about 47.54 %. The prevalence was very high in laying hen (52.8%) compared to grower (42.8%) and prelayer (16.6%). The prevalence of *Avibacterium paragallinarum* in Dinajpur, Rangpur and Thakurgaon were found 86.67%, 25%, and 34.21% respectively during winter season but it was found 9.09%, 0% and 0% respectively in summer season. Out of 122 samples, positive cases were found 57, 58 and 56 respectively by cultural, Microscopic and biochemical examination. The isolates were resistant to norfloxacin and tylosin but sensitive to amoxycillin and gentamicin. From the positive isolates, 58 representative isolates were used for DNA extraction by EZ -10 Spin Genomic DNA kit (Bio Basic Inc.) according to the manufacturer recommendation for molecular characterization. Among 58 representative isolates only 4 produced the specific band for *Av. paragallinarum* in PCR test.



Primer, Lader, PCR
Mastermix, PCR product

Epidemiological investigation of anthrax and determination of efficacy of local anthrax vaccine in Bangladesh: The research project was designed to reveal the causes of repeated outbreak of anthrax in Bangladesh as well as to investigate the efficacy of local anthrax vaccine produced by LRI, Mohakhali, Bangladesh. Based on the previous outbreaks,

Shahjadpur and Ullahpara of Sirajgonj district, BograSadar, Khustia, Tangail and Mymensingh were selected as the study areas. To reveal the present status of knowledge, attitude and behavior of people to anthrax, data were collected using a semi-structural questionnaire. The environmental parameters viz., soil parameters like physical nature, pH, moisture, Ca content were determined by physical and chemical analysis; whereas, data related to temperature and rainfall were collected from the official website of world weather. Suspected soil, blood and swab samples were subjected to microbiological analysis at the Department of Microbiology and Hygiene, BAU, Mymensingh, Bangladesh to isolate and characterize *B. anthracis*. The efficacy study of the local anthrax vaccine was performed at the Lalteer Dairy Research and Development Farm (Lalteer Livestock Limited). The present study revealed that 56.67% people of the anthrax affected area lack knowledge about the disease, its outbreak and the consequences. On the other hand, the existing knowledge level of the people regarding proper carcass disposal, washing of grasses and vaccination of susceptible animals was significantly poor. A total of 120 soil, 1 blood and 4 swab samples were examined, and *B. anthracis* was isolated from 14-soil, the blood and all the swab samples. Data derived from the physicochemical study of the soil samples were analyzed based on the presence or absence of *B. anthracis* and season. No significant difference was found between anthrax positive and negative samples in regards to their moisture, pH, Calcium and organic carbon contents. However, the moisture and Ca content of soil samples collected in the anthrax prone season (May-November) differed significantly from that of dry season (December-April). Serum samples were collected from the animal vaccinated with anthrax spore vaccine with a defined interval up to 12months, and the antibody titers were determined by ELISA. The anthrax vaccine produced in Bangladesh was found effective up to 12months. Based on these findings, it is concluded that social, managerial and environmental factors positively influence the repeated outbreak of anthrax in Bangladesh, and anthrax vaccine produced by LRI can be used for the prevention of anthrax outbreaks in Bangladesh.

Core Research Activities of NARS Institutes (BLRI)

The Livestock Division of BARC is responsible for scrutinizing and coordinating the core research programs of Bangladesh Livestock Research Institute and devoted itself performing the following duties:

- Reviewed the annual research programs and suggested improvement avoiding wasteful duplication.
- Provided technical support and guidance based on national policy and demand in planning the institute's research programs.
- Done field level monitoring and evaluation of the core research projects to provide technical support and to suggest further improvement.
- Participated in the review workshops, board of Management meetings, different technical committee meetings, recruitment of scientists and other staffs of the institute.
- Done mid-term evaluation of the on-going research projects.
- Done annual evaluation of the completed research projects.
- appropriate health management and control methods for different livestock and poultry diseases;
- appropriate food hygiene and safety technologies and herbal medicinal drugs;
- suitable breeds of livestock and poultry for increasing production of milk, meat and eggs;
- suitable feeds and fodder varieties with their production, improvement and preservation techniques;
- suitable storage facilities and marketing systems for the livestock products and byproducts.

With the above-mentioned research mandate, BLRI conducted a total of 40 research projects/programs during the year 2013-2014. Research highlights of some these projects/programs are given below:

Research Highlights of NARS

Among the various other agencies and institutes, Bangladesh Livestock Research Institute (BLRI) is the only NARS institute working with the mandate of identifying and solving the basic problems of livestock development through research and demonstration in the country. BLRI, with its other various jobs is working to develop

- suitable methods for quick diagnosis and treatment of various livestock diseases;
- appropriate technologies for production of suitable vaccines and biologics;

Maintenance and conservation of Shuvra parent & promotion of Shuvra:

The research was aimed to maintain and conserve pure lines of Shuvra parents and motivation of farmers for Shuvra rearing. Body weight, egg production and egg weight at 38 weeks of age were increased while age at sexual maturity was decreased than the pure lines of previous generation. In conclusion, the maintenance and conservation program of pure lines at BLRI seems to be in right direction as performances of the pure lines are gradually improving. The promotional activities of Shuvra should be continued giving emphasis on vent sexing so that the farmers could get smooth supply of Shuvra DOC.



Shuvra (BLRI Layer- 1)


Performance of BLRI layer-1 (Shuvra)

Parameter	Performance
Live weight at 30 wks (g/bird)	1700
Feed intake (g/bird/day)	115-120
Age at first egg (week)	19
Annual egg production	280-295
Egg weight at 38 weeks (g)	62

Field trial of BLRI layer-2 (Shorna): BLRI has developed a new layer strain named BLRI layer-2 or "Shorna" that can produce brown shelled eggs. The on station performance found satisfactory and the layer need to be judged under field condition before releasing

for commercial production. For that purpose, about 3000 female chicks distributed among the three pre-selected farmers in 3 areas of the country e.g. Shorishabari, Jamalpur; Babuganj, Barisal and Kalihati, Tangail. The live weight, feed intake, sexual

maturity and mortality count was appreciable. Performance of BLRI layer-2 seems to be promising until this period but finally we will compile all the information as a brown shelled commercial layer.

	Performance of BLRI layer-2 (Shorna) at 20th wks										
Shorna (BLRI Layer-2)	<table> <tr> <th>Parameter</th><th>Average performance</th></tr> <tr> <td>Live weight (g/bird)</td><td>1531.67</td></tr> <tr> <td>Feed intake (kg/bird)</td><td>7.8</td></tr> <tr> <td>Age at first egg (day)</td><td>135.33</td></tr> <tr> <td>Mortality (%)</td><td>5.67</td></tr> </table>	Parameter	Average performance	Live weight (g/bird)	1531.67	Feed intake (kg/bird)	7.8	Age at first egg (day)	135.33	Mortality (%)	5.67
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Mortality (%)	5.67										

Conservation and improvement of native chicken:

The study was conducted with a total of 1278-day-old chicks comprising of 3 types of chicken namely Naked Neck (NN), Hilly (H) and Non-descript Deshi (ND) considering the following objectives (i) to assess the performances of three indigenous chicken genotypes under intensive management (ii) to estimate covariance components and genetic parameters of economic traits of Indigenous Chicken genotypes and (iii) to estimate realized responses to selection to improve 3 Indigenous Chicken genotypes. Significant

body weight differences among the genotypes were observed at the age of first egg lay, with the highest body weight observed for H (1499.0±9.5g) genotype. In terms of body weight, H genotype was superior. Based on the performance of produced generations, the study revealed H genotype to be a good starting material for improving meat production. Response findings in different traits indicated an impetus for continuing the pure breeding selection program for more generations.

		
Common deshi	Hilly	Naked neck

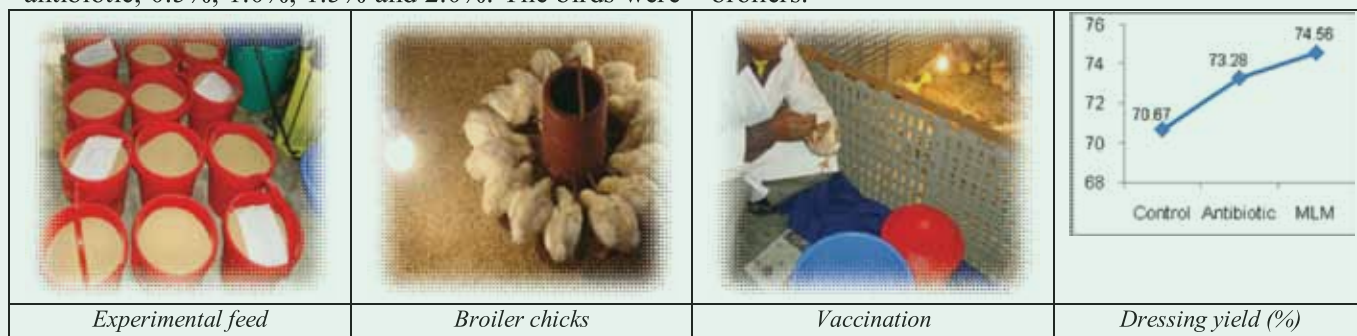
Conservation and improvement of Quail: The study was conducted with four genotypes of quail like Japanese (J), White (W), Black (Bl) and Brown (Br) quail are being maintained at BLRI with the objective to develop a suitable meat type quail genotype for our existing farming. Significantly higher body weight was found in W and Bl followed by Br and J quail genotypes at different period of age. Significantly more

number of eggs was obtained in Bl (97.31) followed by J, Br and W respectively. Based on the performances W and Bl quail were superior for body weight and Bl quail for egg production. These findings give us more attention for continuing the quail breeding research for producing a suitable meat type quail genotype in our country.



Study on moringa leaf meal (MLM) as natural feed additives on the growth performance and meat quality of commercial broiler chicken: A study was conducted to investigate the effect of Moringa leaf meal as an alternative to antibiotic and natural feed additives on the growth performance, meat quality and carcass yield of broilers. Broilers were assigned to 6 different inclusion levels of MLM diets; control, antibiotic, 0.5%, 1.0%, 1.5% and 2.0%. The birds were

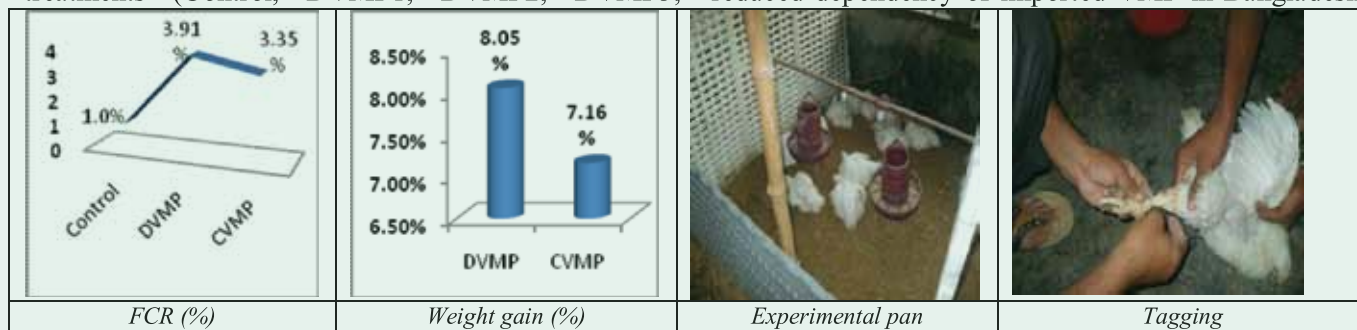
fed the experimental diets and water was provided without restriction throughout the experimental period. The results showed that significance ($p < 0.05$) effect on final body weight and weight gain in dietary supplementation of 1.5% MLM as compared to that control group. Moreover meat quality has also positive response in Moringa added group. MLM in broiler diets can be used for enhancing growth performance of broilers.



Study on screening and development of vitamin mineral premix suitable for poultry:

A study with broiler chicken was conducted to test the efficacy of developed vitamin mineral premix contrast with commercial vitamin mineral premix and control group. A total of 270 day-old broiler chicks were randomly weighed and assigned to six dietary treatments (Control, DVMP1, DVMP2, DVMP3,

CVMP1 and CVMP2) in a group of 45 birds each treatment. FCR reduced significantly in different levels of VMP in both developed and commercial VMP contained diet compared to control diet. The result of the current study reveals that the low to medium levels of DVMP are suitable combination of the developed vitamin mineral premix which obviously could be reduced dependency of imported VMP in Bangladesh.





Conservation and improvement of duck germplasm of BLRI: This study was taken to evaluate the reproduction and growth traits of BLRI developed

native duck germplasm. A total of 504-day-old ducklings comprising of 2 native ducks namely Rupali and Nageswari were hatched for this study. Hatching

data and growth rate data were recorded. Collected data were analyzed by t test. Fertility and hatchability rate of Rupali duck is higher than Nageswari duck. Egg, duckling weight and egg duckling weight ratio was better in Rupali duck. At 4th week of age Nageswari duck had higher body weight but at 12th weeks of age rupali duck had higher body weight. There was no significant variation in feed intake and FCR among the

duck genotypes. As a result of selection, body weight at 12th weeks of age was expected to improve by 49.43 vs 20.01; 53.10 vs 18.08 g respectively for Rupali and Nageswari males and females. The study will be continued for selection of superior parents from 1st generation (based on egg production and egg weight) to produce progenies for next generation.

		Table: Average performance of BLRI developed native duck		
Rupali Duck	Nageswari Duck	Parameter	Performance	
			Rupali	Nageswari
		Fertility %	77	67
		Hatchability %	81	77
		Egg weight (g)	61	58
		Feed intake (g)	152	150
		Egg production (no.)	180-200	200-220

Omega-3 enriched chicken egg production through dietary manipulation: This study was taken to production of n-3 enriched chicken egg. A total 160 White Rock layers, 56 weeks of age were used. The treatments were containing 0 (T1), 5 (T2), 10 (T3) and 15% (T4) linseed with basal diet. Number of egg production almost similar for all dietary treatment groups but higher egg mass found in T3 group. T2 found lower feed intake but get higher egg mass/bird/week. T2 and T3 dietary group found better FCR then other group. Egg lipids were enriched in the n-3 fatty acids of α -linolenic acid and DHA, in the 10% and 15% linseed-fed groups compared with the other groups. The result also showed that different dietary level of linseed in layer ration did not influence the egg albumen quality and yolk index. The inclusion of linseed in layer diet increase n-3 fatty acid content in eggs which is highly encouraging particularly for the health conscious people. The study will be continued for investigating n-3 and other fatty acid in eggs.

Development of two stage probiotic mix fermented feather meal and its performance evaluation on chicken: The two stage mix-probiotics fermentation, a newly fermentation technique, had recently been developed and followed some developed countries. Non sterilized fermented feather meal was used for *Bacillus subtilis* isolation and crop scrapping of chicken was used for *Lactobacillus sporogenes* isolation. The bacterial strains were isolated from the collected samples using the dilution agar method. A

standard volume of the diluted sample was plated on selective agar such as MRS for the isolation of the targeted bacteria and incubated in anaerobic conditions at 37°C for 48 h. Isolated colonies were taken randomly to obtain pure cultures of the concerned bacteria. The purified colonies were tested for *Bacillus subtilis* and *Lactobacillus sporogenes* by microscopic examination using Gram's stain and catalase production techniques. Based on the morphological appearance under microscope the Gram's positive, catalase-negative rods were selected and stored at -20°C in MRS broth, supplemented with 20% (v/v) glycerol for further studies. Besides, multiplication of pure culture of isolated bacteria as a probiotic is ongoing for fermentation of sterilized feather meal. Two stage fermentation techniques will be helpful to digest and utilization of unconventional used feather meal and a well nutritionally balanced fermented feather meal mixed probiotic will be developed. Therefore, it will be reduced the feed cost as well as enhance productivity of chicken production.

Selection of suitable exotic beef breeds (s) and performance evaluation of their crosses

with native cattle: The demand and supply mismatch of beef has been increasing its market price. The conventional beef production system coupled with intensive beef farming may help increasing beef production. Profitable beef production under intensive farming is largely depended on the productivity of beef animals. Brahma crosses are being produced to support

increased productivity, but strategic approach for breed development that needs screening of multiple genotypes is ignored. Thus, along with Brahma some other exotic sires were selected to produce genotype of a cost effective beef production. BCB-1 dam was used to cross with the selected beef breed sires. This requires determination of genetic distance in BCB-1 animals. Blood samples of BCB-1 were collected and mtDNAs were sequenced. It showed that BCB-1 was originated from and maintained by a pure zebu cattle genetic background. The productivity of Brahma×BCB-1 crossbreds will be compared with that of BCB-1 bulls. Finally, a suitable beef breed that will yield an average carcass weight of 150Kg by 24 months of age will be developed.

System modeling for food waste to feed (F₂F)

production: Waste food may be recycled into feed by using a cost effective collection, processing and value addition system. It may contribute to improve environment and feed availability in one hand and reduce environmental pollution and cost of disposal in other hand. An individual contact collection system of wastes from a community and evaluating them in terms of both quantity and quality was conducted. It was found that a household of 4.25 family members in BLRI campus produced 1691g waste daily. Organic waste was 97.7% of household waste, amounting to 1652g. The constituents of organic waste were vegetables, animal sources waste, and grain and paper products, representing 89.2, 3.2, 3.1, and 2.2% of household waste. Thus, every household produced 1509g vegetable waste daily. Household organic wastes were rich in CP (14 to 20%). A feed production business (F₂F) from food waste may be developed by utilizing cost effective collection, processing and value addition system.

Monitoring of highly pathogenic avian influenza virus circulating in Bangladesh and in vitro expression of viral proteins:

Monitoring of highly pathogenic avian influenza virus circulating in Bangladesh was studied. A total of 1135 samples were collected consisting 280 environmental feces samples from migratory birds, 680 swab samples from live bird market chicken, 118 swabs from ducks and 57 swabs from pigeon from different locations of Bangladesh. All the samples were directly tested by RRT-PCR and RRT-PCR positive samples were inoculated in 10-day-old embryonated chicken eggs. Out of 1135 samples, 69 samples were found Hemagglutination (HA) positive which were confirmed by RRT-PCR using

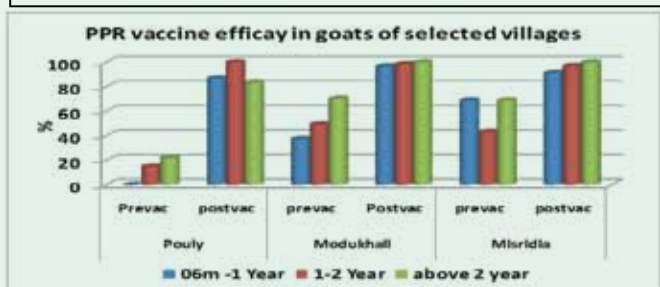
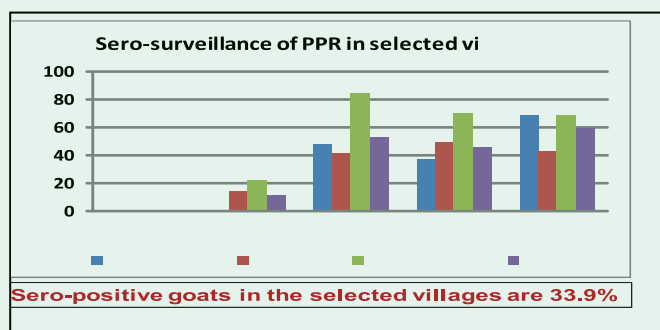
specific primer and probe set of influenza A in which 11 were from migratory birds (11/280; 3.93%), 48 from LBM chickens (48/680; 7.06%), 7 were from ducks (7/118; 6.0%) and 3 were from pigeon (3/57; 5.26%). Out of 69 influenza A positive samples only 04 samples were H5, other 43 were H9 and remaining 22 were undetected subtypes. From this study it was revealed that HPAI (H5N1) has still been circulating in our poultry population and no novel avian influenza virus H7N9 was found during this study. For cloning and in vitro expression study the full length HA gene of selected HPAI isolates has been amplified by RT-PCR and cloned in plasma vector by TA cloning method. The full length sequence of the cloned insert has been established. For in vitro expression of HA protein, specific primers have been designed and synthesized. The protocol of cloning cDNA corresponding to HA coding region in expression vector is now in the process of optimization.

Study on efficacy, potency and safety of BLRI developed enterotoxaemia toxoid:

It was focused in this study on the field trial of *Clostridium perfringens* Type D toxoid against clostridial enterotoxaemia in sheep and goat. The toxoid was developed from the toxins of the isolated strain of *Cl. perfringens* type D. Field trial of epsilon toxoid in natural hosts was done in the selected districts e.g. Manikgonj, Jessore, Naogaon, Tangail and Sylhet. Apparently healthy 520 goats and 460 sheep were vaccinated with different dilution of toxoid subcutaneously. Serum samples were tested by mouse neutralization and agar gel immune diffusion test to check the efficacy of the toxoid. Results showed that BLRI developed toxoid provided a significant protection to vaccinated goats and sheep as demonstrated by its high efficacy (70-90%) after 5 months of vaccination. Adverse effect was not observed in the vaccinated animals during study period. It seems the developed toxoid is effective to protect goat and sheep from enterotoxaemia.

A pilot project on Peste des Petits Ruminants (PPR) control in selected areas of Bangladesh:

A small scale pilot project implementation with objective of PPR control in selected areas of Bangladesh is going on. Baseline study showed that a total of 952 households' rear goats in selected five villages (2 villages of Manikgonj and 3 villages of Jessore district) where number of goats per household is 3.03-3.45. Pre-vaccination sera analysis showed that in three treatment village seropositive goats were 11.36%, 45.39% and 59.72% in Pouly, Modukhali and Misridiara,



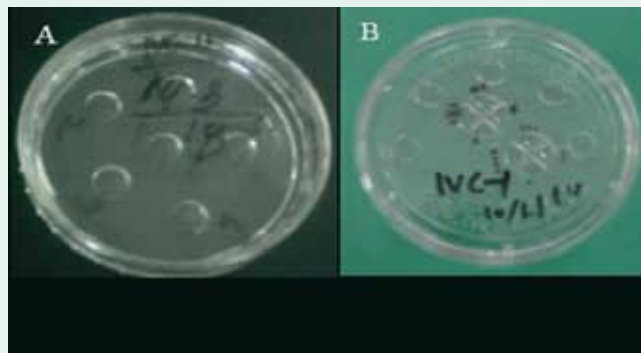
respectively, whereas in the control villages seropositive goats were 0% and 53.03% in Chamta and Bahirampur, respectively. Sera analysis from 21 days post-vaccinated goat from the treatment villages showed that 89.47%, 97.87% and 95.10% are positive in Pouly, Modukhali and Misridiara, respectively. Overall 46.53% goats were seropositive in three treated villages before vaccination but 21 days post-vaccination herd immunity rose to 95.65%.

Development of Boar and Jamunapari goat: Jamunapari and Boar goat breeding program started at Goat Research Station of Bangladesh Livestock Research Institute, Savar, Dhaka from January 2014. Bengal Livestock & Fodder has imported Boar meat goat from South Africa to trial for faster weight gain. At starting period 4 'does' and 1 buck were received by BLRI from Bengal Livestock & Fodder.



All imported animals are rearing at Goat Research Station at BLRI. Green grass (*ad libitum*) and concentrate twice daily (morning and evening) was offered to animals. The pure breeding (Boar goat male × Boar goat female) program was conducted initially at BLRI was designed such way, which resist inbreeding. The data on productive and reproductive performances was recorded. The average birth weight, weaning weight and weaning age of Boar kids were 3.78 ± 0.60 kg, 19.83 ± 0.68 kg and 88.0 ± 1.92 days respectively. The growth rate of Boar kid up to 120 days was higher in male kid (0.187 kg/d) than those of female kids (0.179 kg/d). The average growth rate of Boar kids was 0.180 ± 0.003 kg/d. The average milk yield of first month of Boar goat was 0.867 ± 0.48 kg. The average milk composition such as dry matter, fat, crude protein and ash were $16.34\% \pm 0.53$, $5.63\% \pm 0.20$, $4.08\% \pm 0.14$ and $0.775\% \pm 0.04$ respectively. The days open was 108.50 ± 3.50 days and postpartum heat weight was 46.18 ± 4.93 kg.

Multiplication of Red Chittagong Cow using Ovum Pick Up (OPU) Approach: BLRI is conducting researches on ultrasound-guided trans-vaginal ovum pick-up based *in vitro* embryo production (OPU-IVP) for production and distribution of high yielding dairy cows to increase milk production of the country shortly.



Photograph showing conventional drop cultura (A) and GPHG group culture system (B)

Table: Bovine in vitro embryo development efficiency in different culture systems

Group	% Cleaved (Mean±SE)	% Blastocyst (Mean±SE)
Conventional drop culture (Group A) (1 oocyte/embryo per droplet)	50.0±22.4	0.0 ^b ±0.0
Conventional drop culture (Group B) (3 oocytes/embryos per droplet)	72.2±10.2	13.9 ^a ±9.0
Conventional drop culture (Group C) (5 oocytes/embryos per droplet)	71.7±3.8	10.8 ^a ±4.9
Conventional drop culture (Group D) (10 oocytes/embryos per droplet)	75.5±2.7	16.6 ^a ±3.9
GPS group culture (total 10 oocytes/embryos in four chambers of a droplet)	72.6±6.1	22.6^a±5.2

The present study was conducted to evaluate follicular dynamics of Red Chittagong cattle (RCC) and to develop *Brucella abortus* contamination free culture system for small number of oocytes/embryos. Follicular dynamics were studied in ten heifers and ten adult RCC cows using ultrasonography machine¹). Slaughterhouse bovine ovaries were used to develop *Brucella abortus* contamination free culture system for small numbers of oocytes/embryos. Numbers of total visible follicles were 6.6 in heifer and 7.1 in cow. About 40.91, 45.45 and 13.64 % of the observed follicles were small, medium and large respectively in heifers. On the other hand, the proportions of small, medium and large follicles in cow ovaries were 54.93, 39.44 and 5.63 % accordingly. The diameter of the largest follicle was 9.43±0.34 mm in heifer and 11.2±0.73 mm in cow. The GPS group culture system support blastocyst development from small numbers of oocytes/embryos (Table 1 and Figure 2). The present findings inferred that the ovarian follicle dynamics and the culture system developed through this experiment will facilitate application of the OPU for multiplication of high yielding dairy cows.

Value Chain Analysis of Processed Poultry Products (egg and meat) in some selected areas of Bangladesh: .Driven by economic growth, rising incomes and urbanization, demand is shifting away

from traditional staples toward high-value food commodities and has been increasing demand of food animal origin. There is a lack of reliable data on the nature of high-value poultry commodities (meat and egg) are produced,. To identify, problem and prospects of this sectors addressing our policy makers, planners, and investors and related value chains markets for upcoming days. A total of 246 from 8 categories of stakeholders taking from two districts Dhaka and Chittagong through pretested questionnaire. The surveyed findings showed about 40-45% and 20-25% value added and egg in fast food shop owners whereas 35-40% and 25-30% in hotel; 48-52% and 32-35% in Chinese restaurant; 23-25% and 12-15% in chain super shop on meat and egg respectively. From processors or further processor statement, their average value addition level on processed poultry meat 25-30% and further processed meat 120-125%. Processed business is not flourished up to the mark due to higher production cost involvement compare to open market. It was found for open market cost 4-6% whereas for structured or processed market cost 38-42%. To gear-up processed or further processed poultry products business need to set up a structured in replace of wet market.

Fodder production and marketing system in some selected areas of Bangladesh: The study aimed to determine the income coefficient of various fodder farm households, fodder production, processing and marketing system, estimate cost of production and returns and constrains faced by the producers in production, marketing and processing of fodder and remedial measures. Study revealed fodder production cost was estimated highest Tk 1, 87,598/ha and lowest Tk 1, 71,883/ha for producer and producer cum seller, respectively. Bio-mass yield estimated was highest 214.05 t/ha for producer in Dinajpur and lowest was 201.45 t/ha for producer cum seller in kurigram district. Annual net return was estimated highest Tk 2,12,272/ha and lowest Tk 1,29,806/ha for producer cum seller in Jessore and Kurigram district, respectively. The BCR was highest 2.18 and lowest was 1.75 for producer cum seller in Jessore and Kurigram. Estimated coefficient of variable Fodder sale, Livestock sector and Fodder business were 0.472, 0.312, and 0.770, respectively.

Annual income of Fodder Middleman (In Taka)

Particulars	Dinajpur	Jessore	Kurigram	Rangpur	All area
Annual Income	176200	176500	210700	159640	180760
Income (Fod. Business)	137400	123000	140400	135600	134100
Share (%)	77.98	69.69	66.64	84.94	74.82

Source: Author's calculation based on field Survey, 2014

Study on biomass yield of *Moringa oleifera* by using different level of fertilizers: The study was conducted with an attempt “to estimate the biomass yield of *Moringa oleifera* in summer season by using different level of fertilizers. The experiment was divided in four treatment groups (viz. A urea: TSP: MP = 100: 50: 25 kg/acre; B Urea: TSP: MP = 75: 37.5: 18.75 kg/acre; C Urea: TSP: MP = 50: 25: 12.5 kg/acre and control group, D without any chemical fertilizer). Biomass yield of *moringa* tree were collected at 45 and 60 days. It was found that biomass yield at both 45 and 60 days were higher with low fertilizer application (group C) in summer season (4.52 and 9.67ton/acre, respectively) in first cutting.

Conservation of farm animal genetic resources (FAnGR) at Naikhongchari: The egg and meat of hilly chicken has a unique taste. As the price of native birds in local market are at least 100% higher than other type of table chickens, so interest was made for study of hilly chicken. A total of 111 adult hilly chickens (19 male and 92 female) were reared in open sided poultry house at Naikhongchari regional station of BLRI for 10 months period. The birds were placed in colony cages (4 female and 1 male in each) with littered (rice husk) floor according to body sizes. A standard diet (17.0% CP and 2750 Kcal ME/kg), fresh drinking water was supplied. Vaccination (Ranikhet and Fowl Pox), de-worming and necessary hygienic measures were taken. Natural hatching and brooding were done by broody hens. From the results of this studies it is revealed that, large size Hilly chicken reared at Naikhongchari regional station were improved in body weight. The performances of newly collected Naked Neck Hilly Chicken given an indication of meat type native chicken.



Hilly Chicken in Naikhongchari regional station.

Performances of hilly goat development at farm level: The hilly goats are dwarf breed and known to be famous for its high adaptability, fertility, prolificacy, delicious meat and superior quality skin. The objective of the research work was to determine the phenotypic, productive and reproductive performances of hilly goats at farm level in hilly area at Naikhongchari. Animals were maintained in a semi-intensive rearing system. All goats were housed in a wooden floor house, were allowed to graze for 6-7 hours per day and concentrate feed was offered twice daily during morning and evening at the rate of 200-250 gm per head per day. From the results of this study it is revealed that, the reproductive traits of hilly goat with generation significantly affected on litter size and kidding interval. According to parity the reproductive traits only significant ($P < .05$) effect on litter size. The kid birth weight was increasing trends with increasing parity up to fifth.



Hilly Goat in Naikhongchari regional station.

Development of fodder production model for sustainable year round fodder availability for five dairy cows (RCC): To develop a sustainable year round green fodder production model having 5 (five) dairy cows about 66 decimal (2 Bigha) of land was selected from existing fodder plots under Pachutia Research Farm. The selected land has been divided into two parts i.e. 33 decimal in each. One part (33 decimal) has been brought under perennial (Napier-4) and the 2nd part of land for seasonal (Maize & Matikalai) fodder production. Seasonal feeding pattern is shown in Fig.1. This calculation did not considered the daily labor ways, but it is assumed that a family member can rear 5 dairy cows with his/her family works and may earn Tk.97,691.00 /year on full cost basis. The benefit cost ratio on TVC and TC were 1.86 and 1.66, respectively. it may be recommended that a farmer having 5 RCC with 66 decimal of land may earn substantial share of his/her family income as small-scale rural dairying.

Development of low cost silage technology for the rural farmers: To solve farmers' existing fodder problem during lean period, the study was conducted to develop suitable silage making systems for small and medium scale dairy farmers in Bangladesh. The treatments were Bamboo made doll (inside sealed with polythene), Bamboo made doll, Plastic container & Polythene made like doll. The storage duration was 3 and 6 months. It shows that the cost of production per kg silage under polythene alone was lower followed by Doll with polythene, plastic containers, respectively (2.31, 3.31 and 11.65 Tk./kg). Though the cost of polythene alone was lower it can used only one time but in case of Doll with polythene, the Doll may be used for at least three years and plastic containers, the initial invest was higher. In conclusion, farmers may be used polythene and Doll with polythene for making small-scale silage in Char and/or other locations where small-scale dairying is prevailing and/ scarcity of feeds during lean period.



Silage preparation technique

Establishment of health management package for native sheep of Bangladesh: The study was proposed to explore the disease status of sheep in Bangladesh. The existing parasitic infection in native sheep has been disclosed as high as 89.5%. Out of that higher occurrence of parasitic infection was found in rainy season (97/41%) followed by summer (91.33%) and winter (82.35%) respectively. On the other hand it was revealed that prevalence of helminths in sheep was significantly higher in young sheep (89.27%) than in adult (81.11%) and lamb in (72.41%). Female (91.61%) were found than in male (78.24%) sheep also reported. Plant extracts have been produced from the plants with anthelmintic properties and the in vitro effect of those plant extracts against mature helminthic parasite of sheep have been studied. It was found that common herbs like Neem (Neem; leaves), Mahogany (Mehgoni; seeds), Betel leaf (pan; leaves), Dodder (swarnolota; whole plant) and Bitter gourd (korola; fruit) have noteworthy anthelmintic properties in vitro. Therefore, these plants are being further studied to investigate their in vivo anthelmintic properties in natural host.

Development of feeding system and least-cost balanced ration with locally available feed ingredients for different selected regions: This study was aimed to compare growth and feeding performances as well as economic returns from feeding male dairy, beef cattle and swamp buffalo for quality beef production. For this 15 local male buffalo calves were taken and each having average age 18-22 months and body wt of about 225 kg were divided into three groups, having 5 no. in each group. 3 group buffaloes were given basal feed following as green fodder, UMS and silage. The experiment was carried out for 3 months. At the end of experimental results revealed that the total DM, OM and CP intake from roughage, roughage and concentrate ration, DMI from roughage of %LW and total DMI on %LW were significantly differ ($p < 0.05$). Feed conversion (8.03 ± 3.02) was better for green grass group than UMS and silage group. No significant difference were found regarding DMI from concentrate of %LW, DMI g/kg($W^{0.75}$ /d), metabolic body wt and growth (kg/d) of all group. It is concluded that stall feeding may have better result in growth of male buffalo calves comparable to that after feeding them UMS and silage.

Characterization of buffalo genetic resources in the selected districts of Bangladesh: The study was conducted in Noakhali, Lamipur, Feni, Mymensingh,

Bhola and Moulvibazar district. A total of 360 farmers 60 from each districts were selected having local buffalo and their milk production more than 1.5 liter milk/day/cow. The data on different phenotypic and productive and reproductive traits were measured. The collected data were compiled and analyzed using computer SPSS 11.5 version software. Data on 3 and 6 month BW were not differing significantly by sex and region. Coat color of buffaloes varies from light black, black to grey and horn pattern differ from curved, spiral and crescent. Daily milk yield, lactation length and total milk production of buffaloes were differ significantly ($p < 0.01$) due to regional variation. For milk production /day was found highest in Mymensingh (4.11 ± 0.11) and lowest in Bhola (1.59 ± 0.5) respectively. Age at first heat ranges from 39.42 to 54.45 months. Post partum heat period and calving interval were highest in Bhola and lowest in Feni district and it was 185.84 ± 7.63 , 495 ± 7.63) and 128.41 ± 3.63 , 430.55 ± 176 days respectively.

Identification and antibiogram study of bacterial agents isolated from the milk samples under different locations of Bangladesh: The study was conducted with the objective to identify the bacterial population in the milk samples and their sensitivity to different antibiotics. The bacteria identified were *Staphylococcus aureus*, *Escherichia coli* and *Salmonella sp.*, and their prevalence's were 85.71 %, 48.57 % and 28.57 % respectively. The antibiotic sensitivity test revealed that, in case of *Staphylococcus aureus*, were 32 mm for oxytetracycline, 26 mm for amoxicillin, 35 mm for ciprofloxacin, 27 mm for cefotaxime, 30 mm for ceftriaxone, 30 mm for azithromycin, and 26 mm for erythromycin; in case of *Escherichia coli*, were 5 mm for oxytetracycline, 9 mm for amoxicillin, 22 mm for ciprofloxacin, 30 mm for cefotaxime, 31 mm for ceftriaxone, 15 mm for azithromycin, and 0 mm for erythromycin; in case of *Salmonella sp.*, were 25 mm for oxytetracycline, 24 mm for amoxicillin, 38 mm for ciprofloxacin, 31 mm for cefotaxime, 34 mm for ceftriaxone, 24 mm for azithromycin, and 0 mm for erythromycin.

Research Support

- A. Review of project proposals for operational fund:** Research project proposals of BLRI were reviewed in August, 2013.
- B. Coordination and Review meeting/workshop:** As a member of Technical Committee and Expert Committee of BLRI, attended the committee

meetings in August 2013 and February, 2014 to review the progresses of on-going research projects and to evaluate & approve new project proposals of BLRI.

- C. Monthly/Quarterly/Half yearly/Annual progress evaluation (2013-14):** Monthly, quarterly, half yearly and annual progress reports of eight SPGR sub-projects and Project completion reports of nine SPGR sub-projects of BLRI, BAU, CVASU and BARC submitted in 2013-14 were evaluated.

Support to Avian Influenza/Bird Flue Prevention and Control Programs

As a member of the National Avian Influenza Technical Committee, suggestions and technical support was given throughout the year to prevent and control avian influenza (Bird flue).

Support to Scientists/Officers Recruitment and Research of BLRI

- As a member of recruitment committee, support was given to recruit best scientist/officer and other staffs of BLRI.
- As a member of Technical Committee and Expert Committee, support was given to evaluate the progresses of different approved research projects and to evaluate & approve new project proposals of BLRI in August, 2013 and February, 2014.
- Support was also given to other activities of BLRI.

Support to National Agricultural Technology Project: Phase-1, DLS Part

As a member of different committees of the project, support was given to operate the different project activities throughout the year.

Support to Policy Making Programs Related to Livestock

As a member of the expert committee, support was given directly in policy making programs related to livestock in MOFL, DLS, BLRI and other organizations throughout the year.

Technologies Developed by SPGR Sub-project and Research Grant project

- Development of Multiplex PCR (Polymerase Chain Reaction) based serotype identification of Foot and Mouth Disease (FMD) virus.

- Development of Multiplex PCR (Polymerase Chain Reaction) based differentiation of *Mycobacterium tuberculosis* and *Mycobacterium bovis*.
- An Optimized Reverse Transcription-Polymerase Chain Reaction (RT-PCR) method for the identification of Rabies Virus.
- An Optimized Reverse Transcription-Polymerase Chain Reaction (RT-PCR) method for the identification of Infectious Bronchitis Virus (IBV).
- Qualitative and quantitative detection of *B. anthracis* spores in soil.

Routine Functions

The division performed several other routine activities that included the followings:

- Annual progress evaluation of the research projects (Done in different times);
- Preparation of annual report 2012-13 (done in April, 2014), annual work plan 2013-14 (done in July 2013) and various other documents, etc. (Done throughout the year);
- Review of different documents and preparation of comments on them.
- Dissemination of technical knowledge as a resource speaker in seminars and training programs and rendering technical support to various organizations and agencies as an expert member and resource person: Technical knowledge was disseminated as a resource person/expert in workshops/seminars/trainings/meetings organized by DLS/BLRI/MOFL/KGF/BARC,
 - To prevent and control avian influenza (Bird flue).
 - To prepare National Strategy Plan to control PPR in Bangladesh.
 - As a member of Expert Committee, to evaluate the progresses of different approved research projects and to approve new project proposals of BLRI in August 2013 and February, 2014.
 - As an Expert member/Evaluator, to evaluate the Six Monthly Progress Report of the BAS-USDA project (on livestock) in January, 2014.
 - As an Expert member/Evaluator, to evaluate the 2nd Annual Progress Reports of two ongoing research projects (on Livestock) of KGF in November, 2013.
 - As a resource person and organizer for eight batches of a training course on Peste des Petits

Ruminants (PPR) under a SPGR Livestock Sub-project.

-As a resource person and organizer for two batches of a training course on Diagnosis of important, infectious, zoonotic and emerging diseases of livestock and poultry in Bangladesh under a SPGR Livestock Sub-project.

- Providing technical support to other divisions of BARC (Done throughout the year);
- Providing technical support to different national and international organizations like BAU, CVASU, SAC, BAS, KGF, FAO, ILRI, etc.: (Done throughout the year).
- Technical support was given as a member of National Steering Committee of the BAU part of the UNEP-GEF-ILRI Asia Project on “Development and Application of Decision Support Tools to Conserve and Sustainably Use Genetic Diversity in Indigenous Livestock and Wild Relatives” to operate the project activities in Bangladesh.
- As an Expert, four KGF and one BAS ongoing research projects were reviewed.
- One new BAS-USDA project proposal was reviewed.
- As Expert Reviewer, Technical support/input was given in Annual Research Review Workshop 2013, held at CVASU on 09 November 2013.
- Technical support/input was given to CVASU by joining 11th Annual Scientific Conference in CVASU, held on 06 March 2014.
- Monitoring and evaluation of the various projects:
 - Nine SPGR sub-projects and 2 Research Grant projects under livestock were monitored.
 - SPGR sub-projects and Research Grant projects of other divisions were also monitored.
- Participating different Agricultural (including Livestock) workshops/seminars/conference/meetings/trainings in BARC and elsewhere:
 - Participated successfully different Agricultural (including Livestock) workshops/seminars/conference/meetings/trainings in BARC and elsewhere and provided technical inputs:
 - Workshops/seminars: 12 nos. (local)
 - Conference: 2 nos. (1 local & 1 foreign-international)
 - Meetings: 15nos. (14 local & 1 local-international)
 - Trainings: 3 nos. (local)

- Other unforeseen jobs (if any), relevant to the development of livestock that may emerge during the plan period:
-Attended ‘World Food Day’ programs, ‘World Milk Day’ program, etc.

NATURAL RESOURCES MANAGEMENT

Forestry

Forestry Unit regularly carried out review, monitoring and evaluation of on-going research activities of Bangladesh Forest Research institute and other organization involved in forestry research and development, and provided necessary guidelines.

Project Development and Implementation

Development, coordination and implementation of project are also a major responsibility of BARC. The forestry unit has the responsibility to oversee the forestry and agroforestry related programmes in the country. The forestry unit in collaboration with the partner organizations develop project proposal for funding by the GoB and other development partners. This unit implemented two projects funded by SPGR-NATP Phase-1, PIU, BARC.

The project *Enrichment and conservation of Mangrove Ecosystem* was implemented by Bangladesh Forest Research Institute (BFRI), Khulna. The experimental sites were selected for mangrove species trials in three salinity zones of the Sundarban. Another coordinated sub-project was *Improvement of agroforestry practices for better livelihood and environment* was coordinated by BARC. The participating organizations are: (1) University of Chittagong (Institute of Forestry and Environmental Sciences); (2) Bangladesh Forest Research Institute; (3) Bangladesh Agricultural University (Department of Agroforestry); (4) Khulna University (Forestry and Wood Technology Discipline); (5) Bangabandhu Sheikh Mujibur Rahman Agricultural University (Department of Agroforestry and Environment) and (6) Bangladesh Jute Research Institute.

Research Management/financial Management and Coordination

Field Visits, Review, Monitoring and Evaluation:

Review, monitoring and evaluation of ongoing research activities of Bangladesh Forest Research Institute are

regularly carried out by the Forestry Wing, BARC. Dr. Mohammed Shahjahan, CSO (Forestry) visited 28-31 January 2014 for forestry review workshop and 12-14 February 2014 for technical committee meeting at BFRI, Chittagong. Intensive field visit was carried out jointly with official and Scientist of DAE/NARS and NGOs in various locations of the country for technology selection, monitoring & evaluation. Forestry and agroforestry activities at Khulna University, Chittagong University, BFRI Chittagong, BAU Mymensing, BSMRAU, Gazipur, and BJRI, to Monitor the NATP-SPGR Coordinated sub project on “Improvement of Agroforestry Practices for Better Livelihood and Environment-BARC Component”. Also BFRI-Khulna was visited and monitored for NATP-SPGR subproject “Enrichment and conservation of Mangrove Ecosystem” established at sundarban. Dr. Ahmed Ali Hassan, Former MD-NRM, Dr. Mohammed Shahjahan, CSO (Forestry) and Kazi Noor-E-Alam Jewel, Scientific Officer, SPGR Agroforestry sub-project was frequently visited the sub-project sites and send evaluation reports for the time to time.

Policy Level Contribution

Advising the Govt. for appropriate steps on emerging problems and problems and prospective issues in the field of forestry, agroforestry and other related fields. As an expert member of the national team and member of the working group the scientist of the unit contributed to a number of policy level documents namely -

- Advisory committee meeting and in the expert Committee meeting of Research programme of Bangladesh Forest research institute.
- National Disaster Management advisory committee.
- Food and agricultural committee meeting of BSTI.
- Technical committee meeting of BSTI.
- Technical committee meeting of MoEF.
- WARPO
- Department of Environment.
- Department of Forest.

NAWG meeting to discuss the problem & prospect of agroforestry

Organized a programme planning meeting of NAWG to develop agroforestry system in Bangladesh on 12 March 2014 and discussed the problems and prospects of agroforestry. It was developed a work plan of

NAWG to execute for the year of 2014. A dynamic website (nawg.gov.bd) was build up for disseminate update information of NAWG activities.

Monitoring, Review and Evaluation of programmes/activities of NARS institutes

Review of Forestry Research Programme

Research programme of Bangladesh Forest Research Institute and other organizations involved in forestry and agroforestry research and development have been reviewed and necessary guidelines have been provided. It was observed that BFRI took about 72 research programmes. BFRI was suggested to undertake research programme in future to cater to the needs of the end-users. BFRI was also suggested to take research programme through bottom up approach and organize research programmes through review workshop with the stakeholders involving the related organizations at regional level. Similarly, agroforestry activities of BFRI, IFESCU, Khulna University, BAU, SAU, BSMRAU, BARI, BJRI, CDB and other organizations were reviewed and a national programme was developed.

Activities of the NATP-SPGR Coordinated Sub Project on Agroforestry Practices for better livelihood and Environment

Khulna University (KU): KU is promoting Agroforestry (AF) along the gher dikes in Dumuria and Kaliganj Upazilas. In Dumuria Upazila the farmers were planted mahogany, akashmoni, *Albizia*, etc., in the dikes that are usually remain vacant. Under the plants, different vegetables were grown like tomato, ladies finger, 'Indian spinach, beans, bottle gourd, yam, arum, etc., were grown. The farmers view that gher dikes with agroforestry intervention by KU have already started giving large economic benefits to them. There were some old plantations on the dikes. The farmers had come forward to the plantation programme in the dikes as per suggestion from the project personnels. As such, new plantation of tree species, eg., mahogany, mango, guava, jujube, neem, coconut, betlenut, lemon, etc were grown.

Bangabandhu Sheikh Mujibur Rahman Agricultural University: BSMRAU activities are concentrated in three upazilas in Narsingdi district, one upazila in Gazipur district and upazila in Khulna district. In Narsingdi and Gazipur districts AF practice

is done mostly under jackfruit trees. There are new plantations of litchi and malta in many cases. The associated crops are papaya, cucumber, bringle, lemon, etc., According to the farmers a good return is coming from the AF practice. In Khulna district the tree species are mango, jujube, etc. Various vegetables such as ladies finger, arum, raised gourd, sponge gourd, cucumber, etc., are successfully grow inter-space fetching a sizeable income to the farmers. Thus, intercropping in mango and jujube plantation is a successful activity. Tall trees like mahogany, coconut, betel nut, etc., in the boundaries of the farm land even do not interfere in production of the intercrops. These inter space was previously remained vacant.

Bangladesh Jute Research Institute: BJRI activities concentrate growing late jute seeds in agroforestry practice. Most of the sites in Faridpur region were still water-logged till the 3rd week of September. The plots selected for growing of jute seed are arable lands that are planted with mango, litchi or mahogany. The plantations are of 1-3 years old. Mango and litchi have been planted with wider spacing, and may be suitable for under-planting. But forest tree species like mahogany are closely planted. As such it may be suitable for under-planting up to 4-5 years of age of the forest tree species.

Bangladesh Forest Research Institute: BFRI has come up with satisfactory results in its activities in growing medicinal plants in the experimental plots in Bandarban, Rangamati and Khagrachari Hill districts. It has also made a linkage of the relevant farmers to sell their produce to a medicinal company.

Institute of Forestry and Environmental Sciences, Chittagong University: IFESCU is working with the tribal people in Kaptai upazila to promote AF through community mobilization. To this end, 3 community communities have been formed with the people in villages. However, IFESCU should gear up its activities.

Bangladesh Agricultural University: The BARC monitoring team visited at Char Kalibari, Mymensingh and found the farmers harvesting carrot, bitter gourd, sweet gourd, chili, jujube, etc., grown as associated crops under trees. The farmers expressed their satisfaction with harvest.

Pictorial View of Field Monitoring



Participation

A number of workshop, seminars conferences, symposia and technical meetings were held during the reporting periods. Contributions were made in the form of paper presentation, as reporter of technical sessions and report presentations, facilitator in the working group; interactions were made as the active participants.

Agricultural Engineering

The unit has the responsibility of research management in the three distinct areas under agricultural Engineering, namely, Farm Machinery, Irrigation and Water Management and Post Harvest Processing Engineering. The unit oversees the major program being undertaken by the NARS institutes for the purpose of further improvement.

Policy Level Contribution

Different policy oriented comments were prepared for appropriate steps on emerging problems and prospective issues in the field of Agricultural Engineering and other related fields. All comments were submitted to the Ministry of Agriculture as per their request through EC, BARC. Some of the activities are given below:

1. Bangladesh Industrial Design Act 2013.
2. Draft contract that that would be signed between Bangladesh and Belarus on peaceful utilization of atomic energy.
3. Proposed integrated small scale irrigation policy
4. Providing information under the activities of *Reducing black carbon from heavy duty vehicles and engines.*

Monitoring and evaluation of Research Program of the NARS Institutes, SPGR- BARC Sub- projects

1. Involved in monitoring of Research Program of the NARS Institutes and other Institutes funded by SPGR, BARC.
2. Evaluated monthly, quarterly, half yearly, annual report and revised budget for extended period of ten SPGR funded project.
3. Involved in monitoring of project activities of the NARS Institutes funded by research grant of BARC.



Linkage

Maintained strong Linkage with the engineering professional bodies in home and abroad like CIMMYT, IRRI, IEB, BWDB, CSAM (Before it was UNAPCAEM), WARPO, BSTI, NGOs, IDE, BWP /GWP, BAS, FAO and Universities etc.

Worked as Member in the Following Committees:

- a. Recruitment committee, BSRI.
 - b. Technical committee on *Feasibility Study and Detailed Engineering for Ganges Barrage Project*, BWDB, Dhaka
 - c. Technical committee on *Agricultural mechanization*, DAE, Dhaka
1. Tour to Thailand, South Korea and Nepal.
 2. Attended various meeting at BSTI
 3. Attended meetings/seminar/ workshops organized by FAO, CEGIS, IWM, WARPO, BARI, BRRI and BCAS.
 4. Convener/ member secretary/ member of various committees PIU-BARC NATP, KGF, BARC (Project Evaluation, Receiving Committee)

5. Review research paper and published research paper in different scientific journal
6. Worked as a co-supervisor in MS research in Irrigation and Water Management Department of BAU, Mymensingh

Development and performance evaluation of an axial flow pump: An axial flow pump was designed and fabricated at Farm Machinery and Postharvest Process Engineering Division, Bangladesh Agricultural Research Institute, Gazipur during 2012-13. The pump was modified to improve its performance during 2013-14. The pump was tested at the vertical lift of 1.2 m, 2.0 m, 3.0 m and 4.0 m and at the pump speed of 1200, 1300 and 1400 rpm. The discharge and fuel consumption increased with the pump speed. But discharge decreased and fuel consumption increased with the lift. The highest discharge (51.52 L/s) was obtained at the lift of 1.2 m and pump speed of 1407 rpm. The lowest discharge (24.65 L/s) was obtained at the lift of 4.0 m and pump speed of 1296 rpm. The pump could not be operated above the speed of 1500 rpm due to the overload of the 12.5 hp engine. Water power increased with the increase of pump head as well as pump speed. During the test, there were some problems identified such as improper shaft alignment, narrow impeller housing, packing leakage etc. This experiment will be continued to the next year for improvement of the pump for its better performance.

Development and performance evaluation of a mini oil expeller: An oil expeller was designed and fabricated at the workshop of the Farm Machinery and Postharvest Process Engineering Division of Bangladesh Agricultural Research Institute, Joydebpur, Gazipur during the period of 2013-2014. The expeller was made of locally available mild steel. Overall dimension of the expeller was 1640 mm×560 mm×985 mm. Four kilograms of mustard (BARI Sharisha-15) was expelled per batch. The average engine and machine speeds were 1166 and 35 rpm, respectively. Average 1.34 kg of oil (crude) was obtained from 4.0 kg of mustard. Oil recovery was 33.50%. The expelling capacity of the oil expeller for mustard was 7.30 kg/h. During operation of the machine some problems were observed. Stop of engine at lower speed and slippage of belt during running were the major problems. The machine will be modified with a gear box to avoid belt pulley system and tested for small and large sizes of oil seeds in the next year.

Brief Highlights of R & D of the concerned NARS Institutes

1.1 Farm Machinery

Design and development of a power tiller operated multi-row weeder for wheat: A power tiller operated multi-row weeder was designed and fabricated at Farm Machinery and Postharvest Process Engineering Divisional workshop, BARI, Gazipur in 2012-13 for weeding of wheat. The weeder was compared with other available weeders namely BARI dryland weeder, hand spade and conventional weeding by using khurpi for wheat to find its performance during 2013-14. The power tiller operated multi-row weeder obtained the higher field capacity (0.123 ha/h) was found. Most at was the efficient tool for weeding, particularly in view of time taken in operation followed by BARI dryland weeder (0.023 ha/h), hand spade (0.012 ha/h) and khurpi (0.003 ha/h). In spite of higher percentage plant damage (4.63%) was done by the power weeder but it has not significant effect on crop establishment. Whereas the cost of weeding was found the lowest (1073 Tk/ha) compared to other weeding tools. Improvement is required for convenient operation of the weeder.

Design and development of a coffee pulper: The most laborious part of the coffee processing is the pulping or removal of outer skin of the coffee cherry. The first step of coffee processing afterharvesting beans and beans are taking out from riper cherries. A drum type coffee manual pulper was developed in Farm Machinery and Postharvest Process Engineering Division (FMPE) of Bangladesh Agricultural Research Institute, Gazipur during 2012-2013. The pulper was made of locally available materials. The clearance between the drums was 3-5 mm and it is adjustable with a knob so that it can pulp the coffee cherries of any size. The pulper was tested during 2013-2014 in the laboratory of FMPE Division, BARI, Gazipur and field test was done at Hill Agricultural Research Station, Khagrachari with the fresh ripe coffee cherries. On the basis of last year experience small modification in design was done. The capacity of the pulper was found 23.08 kg/h. The performance of the pulper was good. Separation of pulped beans from the skins has to done manually. To provide screening facility and higher capacity further research will be needed.

Development of a power tiller operated potato harvester: A Power tiller driven potato harvester has been developed with locally available materials in

Regional Wheat Research Centre, BARI Rajshahi 2013-14. It is a semi-automatic digging machine. Potato harvester acts as digs the potato beds, rotating flat conveyer belt carry loose soil with potatoes and its high speed rotation separate the potato tubers from soil. Finally; pick up the exposed tubers from the soil surface by hand. The potato harvester consist of i) digging blade; ii) conveyer flat chain; iii) Guide plate; and iv) Power transmission arrangement. The dimension of the harvester is 900 × 850 mm. It can harvest daily 8 bigha land depend on operator skillness. Potato harvester requires labour 21 per ha only instead of 60 labours per ha in traditional manual method. Harvesting cost by potato harvester was Tk. 8,357 per ha but manually harvesting cost is Tk.17,100 per ha, respectively. Potato harvester saved 51% cost and 65% labour. Moreover, there are no potatoes remain inside the soil. Potato damage percentage is only 1.21%. Potato growers are always pass in risk of bad weather especially harvesting time. Sometime unpredictable rain causes huge damage of potato in the field. So, potato harvester can cover many areas within limited time and escape bad weather uncertainty and can reduce labour dependency.

Design and development of dry land NPK briquette applicator: A manually operated dry land urea, phosphorus, potassium (NPK) briquette applicator for upland crops was developed at Farm Machinery and Postharvest Process Engineering Division of Bangladesh Agricultural Research Institute during 2013-14. The applicator was developed for deep placement of one NPK briquette by single push. The average depth of placement of was 7-8 cm. Hole coverage was 60 to 70 % and distance between plant and briquette application point was 9-10cm. There was no missing of NPK briquette during laboratory and field tests. Average field capacity of the applicator was 11decimal/h. The treatment were T₁- Application of NPK briquette by applicator 10 days after transplanting (DAT), T₂- Application of NPK briquette by hand 10 DAT, T₃- Application of prilled NPK at briquette dose by hand 10 DAT, T₄- Application of prilled NPK at standard dose by hand 10 DAT and 50 DAT. There was no significant difference of yields among the treatments. This experiment will be continued to the next year for improvement of the applicator for its better performance.

Design and development of a cashew nut sheller: The most laborious part of the cashew nut processing is the shelling or removal of outer shell of cashew nut. It

also has some health implications due to the corrosive action of cashew nut shell liquid on human skin. A vertical disc type sheller was designed and its fabrication work is on going at Farm Machinery and Postharvest Process Engineering Division of Bangladesh Agricultural Research Institute (BARI), Gazipur during 2013-2014. The sheller was made of locally available materials. The clearance between the disks is adjustable so that it can shell the cashew nut of any grade. The sheller will be tested in the laboratory of Farm Machinery and Postharvest process Engineering Division, BARI, Gazipur after completion of the fabrication work. The performance and economic analysis will be done in the next year.

Design and development of an onion stem cutter: Onion is an important spices in Bangladesh. Bulb of onion is to trim from the stem. So, tops of onion are cut at 1.5-2 inches above the onion bulb. This operation is done manually in Bangladesh which is laborious, time consuming and costly. An onion stem cutter was designed and fabricated in Farm Machinery and Postharvest Process Engineering Division of Bangladesh Agricultural Research Institute, Gazipur during 2012-13. The stem cutter was made with locally available materials and operated it with a 0.37 kW electric motor. Important parts of the machine were feeding table, conveyor, cutter and outlet. The stem cutter was developed and tested during 2013-14. Capacity of the stem cutter was 75 and 50 kg/h for onion and dried garlic respectively.

Performance evaluation of power groundnut sheller: Shelling of groundnut pod is laborious, time consuming and cost involving operation. Traditionally groundnut pods are shelled manually in Bangladesh. A power groundnut sheller was designed and fabricated in Farm Machinery and Postharvest Process Engineering Division, Bangladesh Agricultural Research Institute, Gazipur during 2011-12. Field performance evaluation was done during 2013-14. The shelling capacities of power groundnut sheller were 110 and 114.72 kg/h for Dhaka-1 and BARI Badam-8 respectively at Gazipur. The shelling capacity of the power groundnut sheller was observed to be 109 and 114 kg/h at Nagarbari and Sujanagar, respectively. The breakage of the groundnut was more at Pabna than that of Gazipur. In all places, winnowing efficiency was found to be 100%. Farmers showed their positive interest in power groundnut sheller for confectionary purposes but negative interest for shelling groundnut as seed.

Fine tuning of power tiller operated bed planter: A power tiller operated bed planter has been improved with locally available materials in Wheat Research Centre, BARI Rajshahi and adaptive trials were conducted in the farmers' field of Rajshahi and Dinajpur area 2013-14. The bed planter was improved and fine tuned with the introduction of operator's seat, attachment of especial size pulley for rotary speed increase and introduction of inclined plate seed meter for various crop planting. The operator can drive it in ridding position. It solved the problem of long distance travel and enhance adoption considering the added advantage of easy comfortable operation. The size of pulley was 8.5". Power transmission chain of the bed planter was divided into two parts avoiding shaking of chain during over come land boundary (aiel). A Saifeng type bed planter also developed first time at BARI Rajshahi. Earlier only Dongfeng type bed planter was available. The bed planter formed a trapezoidal shape raised bed and can perform seeding and fertilizing operations on the top of the bed simultaneously in one operation. The bed planter is to be attached behind the power tiller (these are readily available in Bangladesh with reports of up to 700,000 within the country). The seeding quality of the planter has been improved with the introduction of inclined plate seed meter for seeding wheat, maize, rice, sesame, jute, pulses and other small seeds. The implement comprises of four major components, namely- rotary tilling part, furrow opener, seeding unit with metering mechanism and bed shaper. This configuration is suitable for seeding on permanent bed also. Performance of the implement was tested for wheat, maize, mungbean and rice cultivation. The uniformity of maize seed spacing was 86-95%. The density of rice and wheat residue were 1.8 t/ha and 1.6t/ha in the tested plot, respectively when seeding on permanent bed. After initially forming the bed, an additional advantage was that reshaped bed can be used for next crop without any further tillage operation keeping it permanent. Fresh bed saved 21.5% and permanent bed saved 34.1% irrigation water over conventional flood method of irrigation with less number of labour involvements. Water logging problem can be avoided introducing bed planting system, especially in rainy season crops. Bed planting allows earthing up, so no need sub sequent earthing up in maize cultivation. Bed planting saved 44% tillage cost compare to conventional method. Maize planting cost in new bed and permanent bed was 63.0% and 72.5% less than conventional seeding method. Average wheat and maize yields were 4.8 t/ha and 8.3 t/ha, respectively. The same wheat and maize yields in

conventional method were 3.6 t/ha and 8.2 t/ha, respectively. Yield advantage was 33% over conventional method. Net return for wheat cultivation in bed planting is 1.2 times than conventional system. For maize planting, no need earthing up in bed planting system. The bed planter is now using as custom hire basis in the farmers' field. There are about 5450 ha lands under bed planting system.

Field performance evaluation of hand operated no-till seeder for crop establishment: No-till farming has many advantages in different ways. Less tillage of the soil reduces labor, fuel, irrigation and machinery costs. No-till can increase yield because of higher water infiltration and storage capacity, and less erosion. No-till farming can be more profitable if performed correctly with appropriate machinery. Li-seeder is a manual seeder for no-till planting developed by Conservation Tillage Research Centre, China. Two Li-seeders were collected from China Agricultural University, China in the year of 2013. To evaluate the field performance it was tested for maize (BHM-7) in research field of Farm Machinery and Postharvest Process Engineering Division of Bangladesh Agricultural Research Institute (BARI) during April and May 2014. The performance of Li seeder was found good and detailed study will be made in next year.

Status and feedback of selected BARI developed farm machinery available in farmers' field: This study was conducted twenty upazilla of ten districts of Bangladesh to identify the status and problems in operation of BARI developed selected farm machinery in the farmers' field. Field data was collected through field survey from 30 adopter and 30 non-adopter farmers from each of the upazilla using pre-tested interview schedule during the period of 2013-14. The socioeconomic profiles of adopter and non-adapater respondents in the study areas were found similar. Distribution of different BARI developed machinery in the study areas were not found uniform. The distribution of machinery was based on type of crops grown and degree of farmers acquainting through field demonstrations and training. Most of the machine owners used machine in their own works and rented to other farmers at custom hire basis. The rates of rent in all locations were found more than double of operating cost. Some problems faced by the users during operation of the machines. Some of the problems related to design the machine, manufacturing defects, improper operation and associated with the engine or

motor. These problems may be eliminated by concerned group for smooth operation of the machines.

Development of suitable package for transportation of pineapple: The corrugated fibre board (CFB) packages were designed in Farm Machinery and Postharvest Process Engineering Division, BARI, Gazipur in 2013 for packaging and transportation of honey queen pineapple. Dimensions of both the 5ply and 7ply CFB packages were 500×300×200 mm and 510×310×250 mm, respectively for holding 10-11 kg of honey queen pineapple. The load bearing capacities of the 5 ply and 7 ply CFB packages were 50 kg and 70 kg, respectively. The fruits were packed in different packaging materials viz. bamboo basket, CFB carton, and plastic crate. Matured pineapple of honey queen was purchased, sorted and packed in three packages from Khagrachuri in 2013, and Rangamati in 2014 and transported to Gazipur by a pickup van. Then the pineapple packages were opened in FMPE Division, BARI, Gazipur at ambient temperature ($29 \pm 2^\circ\text{C}$) and humidity ($79 \pm 2\%$). The CFB carton of 7 ply was better than that of CFB carton of 5 ply. No injury of fruits and damage of packages were observed. The lowest weight loss(0%) of pineapple was found in wrapping with 2% perforated polyethylene (0.05 mm). Packing cost of CFB carton was higher than those of plastic crate and bamboo basket. Plastic crate should be used for local market to transport the fruits. CFB carton may be used for export market or supper market. This experiment will be continued to develop accurate size of carton and to make proper ventilation spaces for reducing the water condensation inside the cartons.

Enhancement of shelf-life of papaya through pre-treatments: After harvesting, papaya is infected by postharvest disease caused by some fungi. The quality and quantity losses of papaya occur due to disease attacks and lack of proper postharvest handling. Fungus can be destroyed or made inactive by chemical or heat treatment. Most of the chemicals are hazardous for human health. Heat treatment technology is simple and is a non-chemical method to kill or inactivate pest and to control fungus. The matured papayas were treated by hot water at different combination of exposure times and temperatures. One treatment combination (50°C for 35 minutes) out of 20 treatments was better performance to treat the fruits. It revealed that a little bubbles on the surfaces like milk colour came out from inside of the treated fruits. The effective combinations of temperatures and exposure periods of papaya were found to be 50°C for 35 minutes. When the papaya

fruits were treated with hot water, the shelf-life of the fruits were found to be increased by 60% and the postharvest loss reduced by 33.33% over untreated fruit. Colour of papaya of this treatment was not deep yellow. In the next year, 3-4 better treatments out of 20 treatments will be conducted to the best combination for longer storage period and better yellow colour.

Development of heat pump dryer for heat sensitive crops: A heat pump was designed and fabricated in Farm Machinery and Postharvest Process Engineering Division, Bangladesh Agricultural Research Institute, Gazipur during 2013-14. The heat pump consisted of rotary compressor (2.75 kW), coil type condenser, expansion valve (electronic control) and hydrophilic type evaporator. The average temperature difference between outlet and inlet of heat pump was 10.39°C . At heat pump outlet temperature of 40°C , the outlet relative humidity was 53% that was 10% less than the ambient relative humidity. The average relative humidity difference between outlet and inlet of heat pump was 13%. Air velocity and airflow rate increased with the increase of air temperature of heat pump. Therefore, the heat pump was found suitable for drying heat sensitive crops at lower temperature. The dryer was designed and will be fabricated and tested in the next year.

Production of biodiesels from jatropha seeds and use in farm engines: Farmers are facing severe power crisis especially in irrigation season. Non-edible biofuel like jathropha oil can be used as substitute to diesel in rural areas for farm engine operation. About 100 jathropha (*Jatropha curcas* L.) branches/cuttings of local variety were planted in the unused land (fencing sides) of Farm Machinery and Postharvest Process Engineering experimental field in 2010. Last year (2012-13) proximate analysis was done of extracted jathropha oil. Tillage operation was done with a 12.5 hp power tiller using jathropha oil at 50% blending ratio. This year (2013-14) jathropha plants are in fruiting stage. After harvesting, jathropha oil will be extracted with newly fabricated oil expeller and oil will be used for the performance evaluation of power tiller engine at idle and load condition at various blending ratio.

Development of solar dryer for drying of spices seeds: A solar dryer was designed, fabricated and installed at Spices Research Centre, Shibganj, Bogra in 2012-13 for drying of spices seeds. During 2013-14, the dryer was modified for better performance. The

average dryer temperature was significantly higher than that of ambient temperature. There was no significant difference of temperature between upper and lower trays. The drying rate of upper tray was found to be higher than that of lower tray and lower tray was found significantly higher than that of open sun drying. 2.1 kg Dried chilli of were obtained from 10.1 kg fresh ripe chilli in the dryer. There were 12.6 kg fresh harvested fenugreek and after drying produced 8.2 kg dry product in the dryer. Similarly 8 kg fenugreek was used for open sun drying and obtained 5.5 kg dried fenugreek. There were 9.3 kg and 21.3 kg fresh harvested fennel and onion were dried in the dryer. After drying 4.2 kg and 12.9 kg dried fennel and onion produced. Similarly 3 kg and 6 kg dried fennel and onion was found in open sun drying from 7.5 kg and 10 kg sample respectively. The final moisture content of seed was found lower in the dryer than that of open sun drying. The open sun chilli seed germination was found 85% and germination in the dryer was found 82%. The germination of fenugreek in the dryer and open sun was found 90% and 88% respectively. The germination of fennel and onion in the dryer were found 11% and 8% respectively whereas for open sun the germination was 75% and 79% respectively.

Evaluation and extension of power tiller operated potato planter in the farmers' field: A low cost power tiller operated cup type potato planter was developed in Bangladesh Agricultural Research Institute (BARI) Rajshahi which can plant whole tuber potato seeds as well as cut piece potato seeds automatically in furrows at predetermined regular intervals. Potato planter maintains a single row of spacing 600 mm and seed to seed distance average 200-250 mm for whole tuber seed and 150-160 mm for cut piece seed. This planter singularizes the seed by a series of cups equally spaced that pass vertically through the secondary seed box for taking one piece of seed per cup. The planters perform four mechanical functions simultaneously, viz., opening furrow, metering the seed, and making beds along with covering the seed. Performance of the planter was evaluated in the farmer's fields to determine the effect of forward speed and seed sizes on the uniformity of spacing and seed missing during 2013-14. Four speeds and three seed sizes were varied to evaluate the planter. Uniformity of spacing varied with the increase of operational speed. It was found that forward speed of 2.4 km/hr is the best in respect of uniformity of spacing and missing seeds. Seed sizes of 35mm were found the best in respect of uniformity of spacing (94%) at the speed of 2.4 km/hr. Field demonstrations were

conducted at on station and the farmers field of Puthia, Paba Rajshahi. The average effective field capacity of cup type planters were 0.10 ha/hr and missing seed was 3%. Potato planter requires 4 man-days/ha compare to 67 man-days/ha in conventional manual planting method. Potato planting cost were Tk.4804/ha. On the other hand, using whole tuber and cut piece seed, manually potato planting cost was Tk.14,740/ha and Tk.16940/ha. Labour requirement for whole tuber seed planting in case of planter and conventional method were 4 man days and 67 man days, respectively. There are no significant yield difference between potato planter and conventional methods. Manufacturers and operator trainings were conducted under the project works. Farmers field day was also conducted near the potato field showing the crops condition of mechanically planted plots and conventional planted plots. Potato planter can save labour requirement of 63 man-days/ha and planting cost Tk9936/ha which was equivalent to 94% and 67% saving of labour and planting cost, respectively compare to conventional manual potato planting method.

Production of biogas and organic manure from press mud and sugarbeet pulp: An experiment was conducted during the cropping season 2012-13 on performance evaluation of beet pulp for producing biogas under the main objective of to promote appropriate technological options to produce biogas. Primarily fresh beet pulp was used as raw material to produce biogas and then chemical analysis was done to determine the amount of methane present in produced biogas. Methane content (64%) in the produced biogas from sugar beet pulp was satisfactory.

Design and development of sugar beet diffuser: Sugar is produced from sugar beet where raw juice is collected through diffusion process. Diffuser for diffusion and slicer to make slice the beet is the main mechanical means of beet processing. This technology is new in our country. So an attempt was taken to design and development of a diffuser during the cropping year 2013-14. Primarily a prototype was developed as per design Plastic drum, water pump, electric water heater and some other accessories were used to make the diffuser. Diffusion capacity was 100 kg/batch/2 hrs and power consumption was 9 KW. After the performance test further improvement will be done as per necessary.

Improvement of water holding capacity of light textured soil through addition of solid wastes: An experiment was conducted at Thakurgaon Regional Station of BSRI during the cropping season 2012-13 to improve water holding capacity and fertility of light textured soil (loamy sand which contain 87% sand, 12.68% silt and 0.25% clay) through addition of solid wastes (ash and press mud). Experiment was designed RCBD with three replication of ten treatments and crop was selected as sugarcane Isd 37. Ten treatments were as T_0 = Control, T_1 =5 t ha⁻¹ Ash, T_2 =10 t ha⁻¹ Ash, T_3 =15 t ha⁻¹ Ash, T_4 =5 t ha⁻¹ press mud (PM), T_5 =10 t ha⁻¹ press mud, T_6 =15 t ha⁻¹ press mud, T_7 =5 t ha⁻¹ (Ash + PM) (1:1), T_8 =10 t ha⁻¹ (Ash + PM) (1:1), T_9 =15 t ha⁻¹ (Ash + PM) (1:1). Bulk density decreased consequently field capacity and saturated moisture content increases. Yield increased significantly due to application of ash and pressmud. Highest yield (63.33 t/ha) was found at T_9 treatment where 15 t ha⁻¹ ash and pressmud were applied at 1:1 ratio. So from the result of this experiment it was found that application of ash and press mud in sandy soil improve physical, chemical property of soil as well as soil fertility and productivity.

1.2 Irrigation and Water Management:

Effect of irrigation levels on quality seed production of hybrid maize: The experiment was conducted at the experimental field of IWM Division, BARI, Gazipur during 2012-2013 and 2013-14 and at RARS Ishurdi during 2013-2014 to investigate the response of irrigation to quality seed production of hybrid maize. Parental lines of BARI Hybrid Maize-9 (BIL79 x BIL28) were sown in isolation (time) maintaining ratio of four female rows alternate with two male rows (4:2). Male rows were sown in two different dates for synchronization. Four levels of irrigation were selected for the experiment. The irrigation levels were T_1 : Two irrigations each at the vegetative (50-60 DAS) and grain filling (110-120 DAS) stages T_2 : Two irrigations each at silking (80-90 DAS) and grain filling (110-120 DAS) stages T_3 : Three irrigations each at vegetative, silking, and grain filling stages, and T_4 : Four irrigations each at (20-25 DAS), vegetative, silking, and grain filling stages. After taking yield contributing and yield data, the seeds of maize were stored to study the seed quality. The results showed that most of the parameters were higher in treatment T_4 . The treatment T_3 gave the highest seed yield both male and female (6.92 t/ha) and (2.97 t/ha) at Joydebpur in 2012-2013 and the treatment T_4 gave the highest seed yield both male and female (8.79 t/ha) and (4.47 t/ha) at Joydebpur and (8.93 t/ha)

and (6.01 t/ha) at Ishurdi during 2013-2014 respectively. The highest germination and seed vigour were observed in treatment T_4 in both the locations.

Effect of irrigation on yield and quality of processing potato varieties: This study was conducted at the research field of Irrigation and Water Management Division, BARI, Gazipur, to obtain more information about the effect of irrigation on yield and quality of BARI Alu-25 (Asterix) and BARI Alu-28 (Lady Rosseta during the robi season of 2012-13 and 2013-14. There were six irrigation treatments, each replicated thrice in a randomized complete block design (RCBD). Furrow irrigation method was used. Yield of tubers increased with irrigation rate as a result of more tubers per plant and large tubers but the percent of malformed tubers also increased. The variety BARI Alu-25 along with three irrigations each at, stolonization, tuberization, and bulking stage and the other one two irrigations each at, stolonization or tuberization along bulking stage were found better to produce the highest yield than other treatments in the first year. In contrast, in the next year, two irrigations i.e., stolonization or tuberization and bulking stage were found better yield than other interactions. The stolonization and tuberization stages were the critical stage to irrigation for processing potato cultivation. BARI Alu-25 produced higher yield and biomass than BARI Alu-28. The highest WU (169.34 mm) and WP and the (31.72 kg/m³) were found in treatment V_1T_6 and V_2T_2 in the first year whereas in the next year, highest WU (190.74 mm) and WP (24.42 kg/m³) were found in treatment V_1T_6 and V_2T_2 . Treatments soil moisture variation within two varieties was more in the next year compared to the first year. BARI Alu-28 produced maximum canopy coverage than BARI Alu-25. Financial feasibility of BARI Alu-25 along with two irrigations i.e. (stolonization and bulking stage) was found better than other treatments. BARI Alu-25 is suitable for producing French fry and BARI Alu-28 is suitable for chips. The variety BARI Alu-28 with two irrigations given each at tuberization and at bulking stage was found better quality (considering TSS, Specific gravity, DM, and Starch) than other treatments.

Effect of deficit irrigation on growth and yield of sunflower: This experiment was conducted at the research field of Irrigation and Water Management Division, BARI, Gazipur, and ARS, Banapota, Shatkhirra during the rabi season of 2013-2014 with sunflower variety BARI Surjomukhi-2. There were

nine irrigation treatments, each replicated thrice in a randomized complete block design (RCBD) with additional spare plot. Furrow irrigation method was used. FI up to 100% FC, DI up to 80% and 60% FC at vegetative and pre-flowering stage were produced highest yield for both locations. Water productivity was highest at DI up to 60% FC at vegetative and pre-flowering stage. Flowering stage was the critical stage for sunflower cultivation. Similarly, water productivity was found better in treatments FI up to 100% FC, DI up to 80% and 60% FC at vegetative and pre-flowering stage than others treatments. The soil salinity at vegetative and flowering stage was found highest in treatments FI up to 100% FC, DI up to 80% and 60% FC at vegetative and heading stage than other treatments at Satkhira. The highest canopy coverage of about 78% was found in treatment FI up to 80% FC at vegetative and heading, and DI up to 60% FC at Vegetative, pre-flowering and heading stage and the lowest was found in treatment DI up to 60% FC at Vegetative and pre-flowering stage at Gazipur. Financial profitability of BARI Surjomukhi-2 was found better at Satkhira than Gazipur.

Effect of deficit irrigation and mulch on onion seed production: The effects of deficit irrigation and mulch on seed yield, water use and water productivity of onion was studied through a field experiment conducted in 2012 - 2013 and 2013 - 2014 winter season at the experimental field of Bangladesh Agricultural Research Institute, Gazipur. Eight treatments comprising of four levels of irrigation regimes (irrigating up to 40, 60, 80, and 100% soil moisture deficit (SMD)) and two levels of mulching (no-mulch and rice straw) were tried. Surface irrigation was used and the crop was planted on beds. Water applied per irrigation, soil moisture contents before and after irrigation was monitored throughout the season while the growth, yield parameters and yield of onion seed were recorded. Deficit irrigation and mulch had significant effect on yield of onion seed. The seed yield ranged from 1040 to 1566 kg/ha in the first year and from 1082 to 1623 kg/ha in the second year, with minimum in treatment of 40% DSM without mulch and maximum in full irrigated mulch treatment. The seed yields of the treatments irrigated up to 80% DSM were not statistically different from those that were fully irrigated (up to 100% DSM). Analyses of results showed that irrigating onion up to 40% DSM reduced seed yield by about 30%. Applying water up to 60% of DSM caused a yield reduction of about 19%. However, irrigating onion up to 80% of DSM reduced seed yield

by less than 4%. Results also revealed that water use of onion crop were largely influenced by the depths of water applied rather than mulching. On average, total water use ranged from 177 to 262 mm with minimum in mulch treatment of 40% DSM and maximum in full irrigated treatment. Total water used by the mulch treatments was only 5.08% lower than that of the non-mulched treatments. While difference in total water applied between mulched and non-mulched treatments was 7.2%. Mulching with rice straw did significantly improve the water productivity of the onion seed crop. The water productivity was found to be the highest (0.71 kg m^{-3}) in the mulched treatment that received irrigation up to 80% DSM with total water use of 220 mm. This treatment also produced near to the highest yield with 22% saving of irrigation water. BCR obtained under deficit irrigated (up to 80% DSM) mulched treatment (5.17) was comparable with that of full irrigated-mulched treatment (5.21). Therefore, in terms of yield, water saving and economics, irrigating up to 80% DSM with mulch gave the best result for seed production of onion.

Determination of crop co-efficient values of garlic by lysimetric study: An experiment was conducted during November to March of 2013–2014 to determine the water requirement and crop coefficient of garlic using a drainage lysimeter. A reference evapotranspiration (ET_o) was simulated with a software, CROPWAT, during garlic growing season. Results showed that crop coefficient values (K_c) at initial, development, mid-season and late season stages were 0.51, 0.87, 1.04 and 0.61, respectively. Though these locally determined values of garlic were differed marginally with that determined by researchers for other regions of the world, but it was comparable. This might be due to the effect of local soil and temperature as well as crop variety on crop ET. However, locally determined values are always preferred to the generalized values for the estimation of crop ET.

Effect of irrigation on the yield and quality of litchi: The study was conducted at RARS, Hathazari, Chittagong and RARS, Ishwardi, Pabna during 2013-2014 to determine the effect of irrigation on yield and quality of litchi as well as to identify the critical growth stages to irrigation. In Hathazari, yield and yield contributing characters varied significantly among the treatments. The litchi yield ranged from 16.18 kg/plant to as high as 42.34 kg/plant. The lowest yield (16.18 kg/plant) was obtained from the T₁ (Non- irrigated tree) and the highest yield (42.34kg/plant) was found from

T₄ (irrigated at flowering and fruit setting stages). The highest amount of irrigation water (384 mm) was used by the highest yielded treatment. The economic return/tree was also the highest (Tk. 2944) from the irrigated trees (T₄). In Ishurdi, The litchi yield ranged from 22.19 kg/plant to as high as 48.51 kg/plant. The lowest yield (22.19 kg/plant) was obtained from the T₁ (Non- irrigated tree) and the highest yield (48.51 kg/plant) was found from T₄ (irrigated at flowering and fruit setting stages). The highest amount of irrigation water (334 mm) was used by the highest yielded treatment. The economic return/tree was also the highest (Tk. 10350) from the irrigated trees (T₄).

Response of different levels of irrigation and mulching to bitter gourd cultivation: An experiment was conducted at the research field of Irrigation and Water Management (IWM) Division, Bangladesh Agricultural Research Institute (BARI), Joydebpur, Gazipur during the kharif-1 season of 2013 and 2014 to find out the interval and quantity of irrigation water required with mulch and without mulch for the potential yield of bitter gourd. Eight different irrigation options with mulch and no mulch were used to see their effects on the yield of bitter gourd. The highest yield (15.31 t/ha and 5.09 t/ha) was obtained from treatment T₆ which received 4 and 3 irrigations at 14 days interval with mulch in the 1st and 2nd year, respectively followed by the treatment T₇ (13.13 t/ha) irrigated at 21 days interval with mulch receiving 3 irrigations in the year 2013 and the treatment T₈ (4.40 t/ha) irrigated at 28 days interval with mulch receiving 2 irrigations in the year 2014. The lowest yield (6.07t/ha and 2.10 t/ha) was obtained from treatment T₄ (28 days interval without mulch) in the year 2013 and 2014, respectively. The seasonal water used by the high yielded treatment (T₆) were 220 mm and 260 mm during the 1st and 2nd year respectively. The non-mulched treatments received higher amount of water use than mulched treatments. The highest BCR also obtained from the treatment T₆ irrigated at 15 days interval with mulch.

Growth, yield and water productivity of garlic under sprinkler irrigation: A field study was conducted in the experimental field of IWM Division, BARI, Gazipur during November to March of 2013 – 2014 to investigate the effect of different irrigation regimes on growth, bulb yield and water use pattern of garlic under sprinkler irrigation systems. The water – yield relationship has been developed for garlic with different irrigation regimes under sprinkler irrigation to quantify crop water productivity functions (CWPF) for

optimum use of irrigation water. Seven irrigation regimes were: T₁ - Surface irrigation where crop was irrigated at 20 days interval; T₂ – Sprinkler irrigation at 40% of ETo; T₃ – Sprinkler irrigation at 60% of ETo; T₄ – Sprinkler irrigation at 80% of ETo; T₅ – Sprinkler irrigation at 100% of ETo; and T₆ – Sprinkler irrigation at 120% of ETo. Marginal water productivity (MWP) and elasticity of water productivity (EWP) were calculated using the relationship between bulb yield and seasonal evapotranspiration (SET). A continuous increasing trend in growth parameters and yield was recorded with the increase in SET up to 100% ETo. However with further increase in SET the same was decreased. Though SET requirement for maximum yield (9.10t/ha) was 254 mm but the highest water productivity (WP) of 3.76 kg/m³ was achieved with relatively low SET of 211 mm, respectively. In terms of bulb yield and WP, sprinkler irrigation found superior over the surface (conventional) one. Sprinkler irrigation with 100% ETo found most suitable for bulb yield of garlic. However, WP was found the highest in sprinkler irrigation with 80% ETo and after that declined with the increase in ETo. Hence, in water constraint situation, 80% ETo would be the most appropriate irrigation level for garlic production with sprinkler irrigation system. This study also confirmed that critical levels of SET needed to obtain maximum bulb yield or WP, could be obtained more precisely from the knowledge of MWP and EWP.

Performance study of alternate wetting and drying furrow irrigation for tomato cultivation: The field experiment was conducted at Gazipur during the rabi season of 2013-2014 to assess a new irrigation method of alternate wetting and drying furrow irrigation (AWDFI) for tomato cultivation. Irrigation was applied through three ways of furrow: alternate wetting and drying furrow irrigation (AWDFI), fixed wetting and drying furrow irrigation (FWDFI) and traditional furrow irrigation (TFI). Each irrigation method was divided into two irrigation levels of 100% field capacity (FC) and 80% FC at each application. The results of the study showed that marketable yield and dry matter in AWDFI was slightly lower compared to TFI, but better than FWDFI when irrigated with 100% FC. The marketable yield was higher in AWDFI than that of FWDFI and TFI when irrigated with amounting to 80% FC. The most important result was that AWDFI saved irrigation water by 37.74% and 33.87% compared to TFI without significantly reduction in yields at the irrigation level up to 100 % and 80% FC, respectively. Field water use efficiency was higher by

34.15% and 37.41% in AWDFI system than that of TFI when irrigated with up to 100% and 80% FC, respectively. The quality of tomato was almost similar among the treatments. The benefit-cost ratio and unit production cost (Tk per kg of tomato) of the treatment AWDFI was attained similar to the treatment of TFI when irrigated with 100% FC. In AWDFI, benefit-cost ratio was viewed greater and unit production cost was attained lower compared to TFI and FWDFI, respectively when irrigated with 80% FC. However, AWDFI is a way to save water for tomato production. This new method may be feasible in drought prone areas where water is limited for irrigation, and further study is required to confirm the results.

Development of nutrient and water management package for summer tomato cultivation under controlled environment: Fertigation was found technically and economically feasible for tomato cultivation in winter as well as in summer season. Use of different levels of micronutrients had a significant effect on the yield and fruit quality of tomato. Considering this hypothesis, this experiment was undertaken with different levels of fertilizers under drip irrigation to develop a nutrient and water management package for summer tomato (BARI hybrid tomato-8) cultivation in sandy clay loam soils of BARI, Gazipur during kharif-II season of 2012 and 2013. Three levels of fertilizers, i.e. $N_{100} P_{55} K_{120} B_{1.0} Zn_{4.0} Mg_{4.0}$ kg/ha, $N_{100} P_{70} B_{2.0} Zn_{6.0} Mg_{8.0}$ kg/ha and $N_{100} P_{55} K_{120}$ kg/ha (control) were considered under drip irrigation applied at 2 days interval. The treatments were arranged with mulch and without mulch. Rice straw was used as a mulching material. The treatment (T_4) with fertilizer doses $N_{100} P_{55} K_{120} B_{1.0} Zn_{4.0} Mg_{4.0}$ kg/ha with straw mulch produced the highest marketable yield of summer tomato (40.98 t/ha and 33.02 t/ha) with minimum cull yield in both the years. The lowest yield (30.96 t/ha and 24.85 t/ha) was obtained from the treatment T_3 having no micronutrients and mulch use. All the mulched treatments received 297 mm and 289 mm of seasonal water whereas the non-mulched treatments received 315 mm and 338 mm of seasonal water in the 1st and 2nd year, respectively. The highest average BCR (3.81) was found in high yielding treatment T_4 in both the years.

Performance of fertigation system on strawberry cultivation: The interactive effects of irrigation and fertilizer on the yields of advanced strawberry line FA-016 were assessed at the central research station, Joydebpur during rabi season of 2013-2014. Two drip

irrigation levels i.e., drip irrigations at two and three days interval, and three fertilizer doses ($N_{110}K_{100}P_{40}S_{25}$ kg/ha, $N_{75}K_{75}P_{40}S_{25}$ kg/ha and $N_{50}K_{50}P_{40}S_{25}$ kg/ha) were tested. Soluble fertilizers like urea and muriate of potash were applied with water through drip irrigation system. Fertigation was done in 4 (four) times at different growth stages. The cumulative effects of irrigation water and fertilizer revealed that the moderate fertilizer dose (N_{75} , P_{40} , K_{75} , and S_{25} kg/ha) and 2 days interval of irrigation produced the highest yield (12.63t/ha) of strawberry. While highest yield was obtained at an irrigation interval of 2 days, total soluble solids and percentage of total sugar was highest (7.7 and 5.20% respectively) in treatment T_1 where strawberry plants were irrigated at 3 days interval with a fertilizer dose of N_{110} , P_{40} , K_{100} , S_{25} kg/ha. The seasonal water use varied from 15.68-21.30 cm throughout the growing period under normal rainfall conditions. The highest net return and benefit-cost ratio was achieved with the moderate fertilizer dose of N_{75} , P_{40} , K_{75} , S_{25} kg/ha with irrigation application at 2 days interval.

Growth, yield and quality of mandarin and sweet orange as influenced by different methods and levels of irrigation: The experiment was conducted at RARS, Akbarpur, Moulovibazar on existing orchard to investigate the growth, yield and quality of orange and sweet orange as influenced by different methods and levels of irrigation from December 2012 to April 2013 and 2014. *Kamla lines 26, 27 and BARI Malta-1* were used as the test crops. The experiment was conducted with 6 years old plants with the same plantation. The four treatments were distributed in a randomized complete block design with four replications. The plant spacing was 4 m x 4 m for mandarin and 3.5 m x 3.0 m for sweet mandarin. The treatments were T_1 : Rain fed, T_2 : Irrigation applied at 10 days interval by ring basin method, T_3 : Irrigation applied at 15 days interval by ring basin method, T_4 : Irrigation applied through drip system at 3 days interval. Measured amount of water was applied to each plant at several intervals to maintain the soil moisture content in the root zone up to field capacity. In irrigated mandarin and sweet mandarin, plants growth showed more vigorous than non irrigated plants. The result revealed that most of the parameters were higher in treatment T_4 where drip irrigation was applied. The highest and the lowest yield of mandarin 756 kg/ha and 310 kg/ha were obtained by treatment T_4 and T_1 , and in sweet orange 4721 kg/ha and 795 kg/ha, respectively was obtained by treatment T_4 and T_1 . Drip irrigation treatments resulted in higher

IWP (3.40 kg/m^3 for mandarin and 5.29 kg/m^3 for sweet orange) with minimum value in comparison to that with ring basin irrigation (1.66 kg/m^3 for orange and 2.28 kg/m^3 for sweet mandarin). The higher BCR was also observed in treatment T_4 .

Growth and yield of sweet orange as influenced by timing of fertilizer application and method of irrigation: This study was carried out at the experimental field of IWM Division, BARI, Gazipur to determine the appropriate timing of fertilizer application and the irrigation method on the growth yield of sweat orange. The experiment was designed with five treatments replicated in five. The treatments were: T_1 = Rainfed (normal practice), T_2 = Irrigation at 10 days interval by ring basin method (November-May) with recommended fertilizer applied two times in a year, T_3 = Irrigation at 15 days interval by ring basin method (November-May) with recommended fertilizer applied four times in a year, T_4 = Drip irrigation at five days interval (November-May) with fertilizer application at two months interval, T_5 = Drip irrigation at five days interval (November-May) with fertilizer application at once in a month. Results of this study indicated that the height and stem diameter were not observed significantly difference among the treatments. But, they were found greater in treatment T_4 with drip irrigation at five days interval with fertilization at two months interval than that of other treatments. The first bearing has been started among the treatments from the current season. However, this is the on-going study. It would be concluded after the completion of the experimental cycles.

Impact of irrigation water salinity on growth, yield and water use of wheat: Water and soil salinity is a determining factor for crop growth and yield. A field experiment was conducted at the experimental field of IWM division of Bangladesh Agricultural Research Institute, Gazipur during December- March, 2013-2014 to investigate the effect of irrigation water salinity on the growth, yield components and yield of Boro rice. Irrigation with four fixed levels (4, 7, 10 and 13 dS/m) and one varying levels (salinity increased as plant grow older) of saline water were compared with fresh water ($<0.5 \text{ dS/m}$) irrigated (control) treatment. All the growth and yield components were negatively affected by irrigation with different levels of saline water. The decreases of growth and yield parameters were not significant up to the salinity of 7 dS/m. Beyond this, a strong negative effect was observed on almost all growth and yield contributing parameters like plant

height, rooting density, leaf area index, spike length, spikelet per spike, number and weight of grain per spike, 1000- grain weight and biomass yield. In all cases, the highest values were recorded in control and the lowest were recorded in higher level of salinity (13 dS/m). Irrigation with saline water of 4 dS/m and fresh water gave identical results in term of growth, yield and yield contributing parameters. The highest grain yield (4.33 t/ha) was found in the control treatment while the lowest (2.83 t/ha) was found in the high salinity treatment. Compared to the low salinity level, medium (10 dS/m) and high salinity (13 dS/m) levels reduced the grain yield by 6.61 and 12.83% and biomass yield by 20.1 and 33.0%, respectively. Whereas varying level of salinity reduced the grain yield only by 4.63% and biomass yield by 6.16%. The water use by the crop ranged from 204 to 258 mm with maximum in no salinity stress treatment and minimum in high salinity stress treatment. Applying varying level of salinity gave almost similar results in terms of growth, yield and yield components with 7 dS/m salinity level. This treatment gave high water productivity of 1.7 kg/m^3 with 223 mm of total water use. Therefore, irrigation with low saline water at the early growth stages and higher salinity water at the later stages might be a good option for growing wheat in saline environment.

Response of wheat to supplemental irrigation with saline water in coastal areas: An experiment was conducted at the Agricultural Research Station, Benerpota, Shatkhiria; Bangladesh Agricultural Research Institute during rabi season of 2013-2014 to investigate the response of wheat to supplemental saline water irrigation in coastal areas of Bangladesh. Two different sources of saline water, viz., best available fresh groundwater (BAW) and canal water, was used for irrigating wheat. Three irrigations given at crown root initiation (CRI), booting, and grain filling stages with BAW (T_1 , control); two irrigations given at CRI, and booting stages with BAW (T_2); one irrigation at CRI stage with BAW (T_3); three irrigations at CRI and booting stage with BAW, and at grain filling stages with moderately saline canal water (T_4) were applied in the study. Wheat was irrigated using BAW and moderately saline canal water according to the treatments. Irrigation water with salinity level ranging from 2.8 to 4.3 dS/m for BAW (groundwater) and 4.6 to 6.4 dS/m for canal water did not significantly influence plant population per square meter, number of filled and unfilled spike per square meter, number of grains per spike, and 1000-grain weight. On the other hand, soil salinity had significant effect on plant height,

number of spikelet per spike, grain and straw yield of wheat. Slight variations in grain yield among different treatments implied that irrigation water salinity had non harmful effects on growth and yield attributing characters of wheat. The highest grain yield (4.30 t/ha) was obtained from three irrigations with BAW (T_1) while the lowest was achieved from treatment T_3 where one irrigation at CRI stage was applied with BAW. The results also revealed that canal water (salinity level of 4.6 to 6.4 dS/m) irrigation at grain filling stage should be avoided for optimum production of wheat though BARI Gom-25 can still produce a reasonable grain yield. Groundwater in the study area was marginally saline (2.8 to 4.3 dS/m) and could be used to meet crop water requirement.

Performance of advanced wheat genotypes under different levels of salinity: This study was conducted in plastic pots at BARI, Gazipur during 2012-2013 and 2013-2014, respectively. 8 (eight) wheat genotypes and 2 (two) varieties were considered for trial during 2012-2013. 4 (four) levels of salinities i.e. 4dS/m, 8dS/m, 12dS/m and 16dS/m were considered for irrigation water. Among the ten genotype/varieties, 5 (five) of them i.e. BARI Gom-25, BAW-1146, BAW-1147, BAW-1150 and BAW-1157 performed well upto salinity of 12dS/m in the first year. These 5 (five) genotypes may be considered for further trial for screening best one against salinity in 2013-2014. During 2013-2014, among the four genotype/varieties, 2(two) of them i.e., BAW-1147 and BAW-1157 performed well upto salinity of 12dS/m. BAW-1146 was not considered for trial due to the non-availability of the seed.

Effect of municipal wastewater irrigation with different doses of fertilizer on yield and biological quality of leafy vegetables: An experiment was conducted at the sub-urban area of Rajshahi city during February–May, 2014 to determine the appropriate fertilizer dose for cultivation of leafy vegetables (e.g., Indian spinach), and to evaluate the microbiological quality of vegetables under municipal wastewater (as referred to wastewater) irrigation. The experiment consisted of five treatments—25, 50, 75 and 100% recommended fertilizer dose (RFD), in combination with irrigation by wastewater, and 100% RFD in combination with irrigation by fresh water, as control. In general, harvest was found higher in the wastewater-irrigated plot with higher doses of fertilizer. Application of 50% RFD in combination with wastewater produced statistically identical crop

attributes and fresh yield with that of application of 100% RFD in combination with irrigation by fresh water, indicating that 50% of fertilizer requirement can be minimized by irrigating with wastewater without any compromise in the yield. Increase in fertilizer dose to 75% RFD or 100% RFD had little effect on increasing the yield. A high bacterial contamination with fecal coliforms, total coliforms, total bacterial aerobic counts and *Escherichia coli* was observed in fresh Indian spinach irrigated with municipal wastewater. However, the crop was not contaminated with pathogenic bacteria of the *Salmonella* species. Therefore, the hygienic aspects of wastewater irrigated crops, especially for vegetable crops, require more attention to sanitary problems.

Assessment of climate change impact on wheat and maize production in Bangladesh using infocrop model: Climate has been changing due to natural forcing. Climate factors such as temperature, rainfall, atmospheric carbon dioxide, solar radiation, etc. Are closely linked with agricultural production. Rice, wheat and maize production would be major concern in recent years due to changing climatic conditions. Simulation study has been conducted to assess the climate change impacts on wheat and maize production in the major wheat and maize growing areas of Bangladesh and the effects of climate changes on the yield of wheat and maize have been assessed using crop growth model infocrop. The simulation was carried out to predict the yields of wheat and maize under different climatic trends of temperature and carbon dioxide concentration. The effect of temperature on the yield of wheat that is negative while of CO_2 is positive but temperature plays dominant role. Prediction was also made to predict the climate change impacts of wheat yields based on historical and IPCC climate change scenarios. From the simulation studies, it is found that wheat yield decreases from 3438 kg/ha in 2020 to 3125 kg/ha in 2050 and from 3358 kg/ha in 2020 to 2850 in 2050 kg/ha for historical and IPCC climatic change scenarios, respectively in Dinajpur region of Bangladesh. For this period the wheat yield decreases by 9.1% for historical trend and decreases by 15.12% for IPCC trend.

Response of wheat to irrigation in saline soils of coastal areas: The study was conducted at the farmer's field of Kulia in Debhata upazilla of Shatkhira during the rabi season of 2013-2014 to study the response of wheat to irrigation in saline soils of coastal areas. The experiment consisted of four irrigation treatments, i.e,

irrigation at initial vegetative stage (farmer's practice T_1), one irrigation at CRI stage T_2 , Two irrigations each at CRI and booting stages T_3 and three irrigations each at CRI, booting and grain fillings stages T_4 . The results revealed that irrigation lead a significant positive effect on the growth, yield and yield contributing parameters of wheat. Grain yield of wheat was found to be increased with increasing frequencies of irrigation. The highest yield (4.08 t/ha) was obtained from treatment T_4 , receiving 3 irrigations at CRI, boeing and grain filling stages, whereas, the lowest (3.02 t/ha) was found in treatment T_1 (farmer's practices) irrigated only at CRI stage. The water productivity was the highest (2.60 kg/m³) when irrigation water was applied at only CRI stage while the lowest (1.93 kg/m³) was attained from treatment T_4 where three irrigations were applied. The soil salinity was found to be gradually built up from 2.49 dS/m - 7.25 dS/m with increasing evaporation and temperature.

Response of mustard to irrigation in saline soils of coastal areas: The experiment was conducted at the farmer's field of the village, Kulia village in Debhata upazilla of Shatkhira district during the rabi season of 2013-2014 to investigate the response of mustard in saline soils of coastal areas. There four irrigation treatments, i.e, irrigation at initial vegetative stage (farmer's practice) T_1 , one irrigation at pre-flowering stage T_2 , one irrigation at pod formation stage, T_3 and two irrigations each at pre-flowering and pod formation stage T_4 . Although no significant variation was observed among irrigation treatments for the growth parameters but grain and straw yield of mustard were found to be increased with increasing frequencies of irrigation. The highest yield (1.52 t/ha) was achieved from treatment T_4 , receiving two irrigations each at pre-flowering and pod formation stages while the lowest (1.42 t/ha) was obtained from farmer's practice (T_1). The highest water productivity (145 kg/m³) was obtained from treatment T_2 that received irrigation at pre-flowering stage while the lowest (1.19 kg/m³) was obtained from treatment T_4 that received two irrigations at pre-flowering and pod formation stages. The salt built-up was minimal at the time of sowing and gradually increased during the later growth stages in all the treatments.

Response of watermelon to irrigation in saline soils of coastal areas: This study was conducted at the farmers' field of Amtali, Barguna to investigate the effects of irrigation on yield and yield components of watermelon (*Citrullus lanatus*) in coastal saline area of

Bangladesh, during January - April, 2014. Irrigations at 5, 10, 15 days interval were compared with farmers' practice irrigation that received a total three irrigations throughout the growing season. The electrical conductivity of canal water used to irrigation watermelon was ranged from 2.6 to 3.4 dS/m. The growth and yield of watermelon responded positively to different irrigation intervals. The frequently irrigated treatment produced the bigger size and higher number of watermelon per plant. Small size fruit and less number of fruits per plant were obtained in farmers' practice (control) treatment. The highest fruit yield of watermelon (37.7 t/ha) was obtained from the treatment plots where irrigation water was applied at 5- days intervals. The second highest yield (33.67 t/ha) was obtained in 10-day interval irrigated plots. Farmers' practice treatment that received irrigation at 25 days interval produced the lowest yield of 20.47 t/ha. Though the yield and total water use (455 mm) was found the highest in 5-day intervals irrigated plots, the water productivity was found to be the highest when irrigation water was applied at 10 days interval while the lowest (1.93 kg/m³) was attained from control treatment. The soil salinity was found to be gradually increased from 2.0 dS/m - 8.52 dS/m with minimum at sowing time and maximum at harvest. Frequent irrigation helped to decrease soil salinity considerably.

Determination of optimum water requirement of BINA developed mustard varieties Binasarisha-7 and Binasarisha-8: The experiment was aimed to determine the optimum water requirement of mustard varieties (developed by BINA) at BINA sub-station, Magura. The irrigation treatments imposed were: T_1 = Control (No irrigation), T_2 = Irrigation at vegetative stage (25-30 DAS) up to 75% of PAW, T_3 = Irrigation at flowering stage (45-50 DAS) up to 75% of PAW, and T_4 = Irrigation at vegetative (25-30 DAS) and flowering stage (45-50 DAS) up to 75% of PAW. The varieties were: V_1 = Binasarisha-7, V_2 = Binasarisha-8 and V_3 = Binasarisha-4. Irrigation treatments did not showed significant effect on yield attributes except 1000 seed weight and seed yield. The cultivars showed significant effect on all yield attributes and seed yield. The highest seed yield (1.55 t ha⁻¹) was obtained from T_3 treatment which received two irrigations (total 7.79 cm), and Binasarisha-4 produced the highest seed yield (1.77 t ha⁻¹). The highest water use efficiency (216.33 kg ha⁻¹ cm⁻¹) was found in T_2 treatment. From the present results, it is revealed that one irrigation at vegetative or flowering stage is sufficient for optimum yield at the study area.

Irrigation management For Binadhan-8 and Binadhan-10 for optimum yield and water productivity:

Binadhan-8 and Binadhan-10 were released as salt tolerant variety. It also performed well in non-saline soil (normal soil). Therefore, the experiment was aimed to find out irrigation management strategy for normal soil for optimum yield and water productivity. The Irrigation management treatments (AWD methods)] were: T_0 = Normal farmer's practice (continuous ponding, 3-5 cm); T_1 = alternate wetting (irrigation by 5 cm) and drying (AWD) at 3 days after disappearance of ponded water; T_2 = alternate wetting and drying (AWD) at 5 days after disappearance of ponded water ; T_3 : 1st week (after transplanting): 2 - 4 cm ponding, 2-3 week: Irrigation (by 5 cm) at 2 DAD, 3-4 week (up to tillering): Irrigation (by 5 cm) at 3 days after disappearance(DAD), 4-6 week (tillering to pre-heading)): Irrigation (by 5 cm) at 5 DAD, 6-9 week (heading – milking): Irrigation (by 5 cm) at 2 DAD, 9-11 week (soft dough – ripening): drying (no additional irrigation). The results indicated that AWD method had no significant effect on the yield and yield attributing characters, except 1000 seed weight. The highest seed yield (5.12 t/ha) was obtained in continuous ponding method (T_0). The variety Binadhan-8 performed better compared to Binadhan-10. Water requirement was the highest in T_0 (91.90 cm) and the lowest in T_2 (64.90 cm). The results also indicated that 5 days AWD irrigation method (T_2) saved about 42% irrigation water compared to continuous ponding method, but without compromising yield; and consequently water productivity was also highest. It can be concluded from the present study that AWD at 5 days after disappearance of ponded water produce almost similar yield to that of continuous ponding method with 42% water saving.

Effects of drought stress on growth and yield of two NERICA rice lines:

The experiment was conducted to determine the drought effects on grain yield, optimum water requirement and water productivity of two NERICA rice lines at BINA farm Mymensingh during Boro season (January-May, 2013). Irrigation treatments were: T_1 = Continuous ponding 3-5 cm, T_2 = Alternate flooding and drying at 5 days after disappearance (DAD) of 5 cm ponded water, T_3 = Alternate flooding and drying at 7 DAD of 5 cm ponded water and T_4 = Alternate flooding and drying (AWD) at 9 DAD of 5 cm ponded water. The cultivars (sub plot treatments) were: V_1 = NERICA-1, V_2 = NERICA-10 and V_3 = Binadhan-8 (control). The results revealed that AWD

method had no significant effect on the yield and yield attributing characters, except 1000 seed weight. The highest seed yield (2.84 t/ha) was obtained in treatment (T_1). The yield of NERICA rice was very low. The variety V_3 produced the highest yield (4.65 t/ha). It is also revealed that 5 to 9 days AWD irrigation method (T_2 , T_3 and T_4) saved about 15 to 25% irrigation water compared to continuous ponding treatment.

Assessment of aquifer exploitation due to irrigation during dry season:

The study was conducted at BINA sub-stations of Ishurdi, Magura, Rangpur, Satkhira and BINA Head-quarters, Mymensingh to assess the surface and ground water withdrawal pattern for its sustainable use. Observation wells were installed earlier at BINA sub-stations at Ishurdi, Magura, Rangpur and BINA head-quarter, Mymensingh. Using water level indicator, WT data were monitored fortnightly which were then interpreted to see the seasonal as well as yearly WT dynamics. Long-term (1992-2013) water table data were also presented for the above locations. Monthly WT fluctuation pattern in the yearly cycle of 2012-13 (June 2012 to May 2013) showed within the suction limit of STW (< 8m) at Rangpur and Magura, but it went below the suction limit at Ishurdi during March to June (Fig. 1). On the other hand at Mymensingh, maximum WT sharply went below the suction limit from January and on-ward till the onset of monsoon (June/July). Long-term yearly WT fluctuation at BINA Head-quarters at Mymensingh and its sub-stations are shown in Fig. 2. It showed that at Mymensingh the maximum depth to WT went below the suction limit of STW from 1992. But at Ishurdi, it was within the suction limit up to 2007 which then had a transition state and from 2010 it went below the suction limit of STW. At other locations, though data missing, it was within the suction limit of STW.

Studies on the surface and groundwater quality for irrigation suitability:

The study was conducted to determine the surface and ground water quality at BINA sub-stations. The water samples were collected at the peak irrigation period in March, 2013, to observe the seasonal effects on the water quality due to the irrigation pumping, monsoon recharge and agricultural practices. Different water quality parameters such as EC, pH, CO_3^{2-} , HCO_3^- , and different cations and anions (Na, Ca, K, Mg, Cl) were analyzed. The CO_3 was determined using titration method, and other cations and anions are determined using spectro-photometry method (from BRAC BARDC, Gazipur). SAR, KR values were calculated. The quality parameters for the

period 13 at different locations are presented in Table 1. Arsenic (As) and CO_3 were not detected anywhere. Results showed that the parameters are within the permissible limit for irrigation except Satkhira. There are no significant seasonal variation of pH, EC and Cl value except Satkhira.

Studies on optimum water requirement of some salt tolerant rice mutants/varieties: The experiment was conducted at farmer's field of Camta village, Debhata, Satkhira, during Boro season (January-May, 2013) to determine the optimum water requirement and water productivity of salt tolerant rice mutants/varieties in saline area. Experimental design was RCBD with split plot having three replications. Irrigation treatments were: T_1 = Continuous saturation with gypsum application at flowering stage, T_2 = Continuous ponding with 2 cm and gypsum application at flowering stage, T_3 = Continuous ponding with 5 cm and gypsum application at flowering stage, T_4 = AWD lowering with 5cm, T_5 = AWD lowering with 10 cm. Mutant/variety tested were V_1 = Rc-222, V_2 = Rc-228, V_3 = Binadhan-8 & V_4 = Binadhan-10. Irrigation water salinity varied from 2.19 to 10.8 (Brackish water with high salinity enters the plot at the end of flowering stage). Plot water salinity varied from 2.65 to 19.05 dS/m. The yield attributing characters showed significant difference for both irrigation treatments and varieties. The highest yield was observed in T_1 treatment (5.83 t/ha) followed by T_2 . Binadhan-8 produce the highest yield (5.55 t/ ha) followed by Binadhan-10 (5.20 t/ha). Interaction effect of irrigation and variety are presented in Table.2. Irrigation was applied by 80 cm, and 90 cm, 101cm, 69 cm and 66 cm in T_1 , T_2 , T_3 , T_4 and T_5 treatment, respectively. It can be concluded from the results that continuous saturation with gypsum application at flowering stage produced the highest yield. Binadhan-8 produced higher yield than Binadhan-10.

Determination of optimum water requirement for sugar beet in sugar mill zone: An experiment was conducted at Bangladesh Sugarcane Research Institute, Ishurdi, Pabna, during the cropping season 2013-14 to find out optimum irrigation water based on climatic and soil data for different sugar beet variety. Experiment was designed split plot with thrice replication for six irrigation treatment and two varieties. Highest yield (78.78 t/ha) was found at I_3 treatment where 5 nos. of irrigation were applied including live irrigation. Highest yield (86.7 t ha⁻¹) was found for treatment V_1I_6 where irrigation at 45 mm Pan evaporation up to 50

DAS then at 75 mm Pan evaporation was used. Highest brix (18.03%) was found for V_1I_3 and V_1I_5 treatment.

Validation of Aqua Crop model under AWD water management and effect of USG in rice production: Irrigation in AWD-15 cm below ground level was the best water application method for Boro rice production and water saving was around 10% for BRRI dhan28 and 20% for BRRI dhan29 along with the higher water productivity. There was no conflict in USG application in AWD method of irrigation. Based on indicators of evaluation for CC and biomass and the required irrigation amounts by Aqua Crop model, the AWD-15 irrigation regime appears to be the best water-saving option for rice production during the dry season in Bangladesh.

Development of soil moisture declination model for alternate wetting and drying (AWD) irrigation for rice cultivation: Experiment was set up in BRRI farm, Gazipur, in Boro season 2014. The experiment contains six treatments and each of them was replicated thrice. The treatments were- T_1 = Continuous standing water (CSW), T_2 = CSW with polythene protection around the field and levee, T_3 = Irrigation when water level 15 cm below GL, T_4 = T_3 with polythene protection around the field and levee, T_5 = Irrigation when water level 30 cm below GL and T_6 = T_5 with polythene protection around the field and levee. The relative yield loss compared to the continuous standing water treatment (T_1) were higher in AWD plots. Water productivity was highest for treatment T_5 (7.25 kg/ha-mm) and lowest for T_1 (5.63 kg/ha-mm). Yield loss was highest in T_6 (17%) and lowest in T_2 (1.3%). Therefore, considering yield loss, water productivity and water saving T_2 and T_4 are found better than the others for irrigated rice cultivation.

Delineation of areas having water shortage during Boro rice cultivation in Northwest Bangladesh: The survey results from 4 upazillas of Rajshahi district found that due to depletion of groundwater level day by day boro cultivated areas decreased and other non-rice crops areas increased. The areas where STW suction limit exceeded installing deep set or very deep set to irrigate boro rice crop.

Effect of drought on different T. Aman varieties: A total of 12 popular T. Aman varieties were grown under irrigated and rainfed environment. These varieties were classified into 3 categories based on the growth

duration. There were 2 short duration, 3 medium duration and 7 long duration varieties. Two water management treatments were as: T₁ - Rainfed condition and T₂ - Supplementary irrigation when water stress was observed. Based on the three years study results, BRRI dhan30, BRRI dhan31 and BRRI dhan40 are found more drought tolerant than the other study varieties. These varieties can be grown in drought prone areas to minimize the yield loss.

Terminal drought mitigation adopting transplanting dates in T. Aman, 2013: A long duration variety (BR11) and a short duration variety (BRRI dhan33) were tested during T. Aman season. There were six treatments with three replications in the experiment and the treatments were transplanting date 10 July (T₁), transplanting date 17 July (T₂), transplanting date 24 July (T₃) and transplanting date 31 July (T₄), transplanting at 7 August (T₅), transplanting at 14 August (T₆). The early establishment of T. Aman through supplemental irrigation effectively mitigated the terminal drought occurred at reproductive and ripening phases during T. Aman, 2013. Both short and long duration T. Aman varieties suffered less drought and showed good yield performance if they were transplanted before 24 July. So transplanting before 24 July would be medium risk period of drought and after that it would be high risk period.

Monitoring of groundwater fluctuation and safe utilization in different geo-hydrological regions: Available water level recorder was used for measuring groundwater fluctuation. Water samples were collected from all BRRI R/S and H/Q for quality analysis. Among the 10 study locations the water of Gazipur, Rangpur, Rajshahi and Kustia were free from sodium toxicity and other six locations had slight sodium toxicity. The pH values of all samples were within the normal range. Therefore, overall the water quality was found suitable for irrigation purpose in all locations.

Testing, validation and upscaling of water saving technology in rice production: The conveyance loss was reduced from 30 to 1 percent and only few second was required to reach water from the source to the tail end of the canal after introducing pipe water distribution system. Average 31.6 percent of irrigation time was saved and therefore, irrigation cost per hectare under head, middle and tail could be reduced by Tk 2,646, Tk 3,162 and Tk 3,168, respectively. Irrigation coverage during Boro season was increased

from 9.9 ha to 21.1 ha after installing PWDS. It means irrigated area was increased by 112% (11.2 ha) in three years.

Integrated agricultural productivity project-BRRI

Part: Water management technologies demonstrated in different locations of Rangpur region in the farmer's fields under IAPP project. Aus rice (BRRI dhan48) cultivated successfully by applying 7-10 supplemental irrigations at the early stage could increase yield up to 30 -50% compared to farmer's management practice. In T. Aman season, terminal drought could be mitigated by applying 1 to 3 supplemental irrigations increasing rice production by 28.28 percent compared to farmer's practice. According to land type 29.5% to 33.7 % more rainwater could be harvested by maintaining 15 cm levee height in research plot than farmer's plot and consequently increased average yield upto 14.37 percent. By practicing AWD method 23.29 % electricity cost could be saved compare to farmer's practice which was little bit higher than diesel operated STW.

Crop and water management for crop intensification in the coastal region of Bangladesh:

In Bazarkhali of Barguna district, freshwater is available in the rivers almost year round. The low yielding aman-grasspea or aus-aman system can be replaced by triple cropping (aus-aman-boro or aus-aman-rabi) using high yielding and stress tolerant rice and rabi varieties of suitable duration. Total annual production can be increased in the polder areas over the farmers' practice. In moderately saline areas like Kismotfultola, Batiaghata of Khulna District, where freshwater is limited during the dry season, the productivity of the traditional aman-sesame system (2.0-3.5 t/ha rice and less than 1.0 t/ha sesame per year) can be increased through adoption of high yielding aman varieties (4-5 t/ha) followed by Boro rice (5.5-6.0 t/ha) and high yielding rabi crops such as sesame and mungbean (1.0 t/ha).

Coordinated project on water management for enhancing crop production under changing climate:

BRRI Component: Rainwater harvesting by levee or bund management during rainfall in the farmer's fields, mean grain yield increased by 13.99 percent in Barisal irrespective of variety. So, preparing higher levee than normal practice around the rice field to reserve rain water during rainy season is an easy and effective water management practice. The levee or bund height should

be 15-20 cm and need proper maintenance from land preparation to end of the season.

Assessment climatic variability effects on T. Aman rice in Rajshahi and Barisal regions of Bangladesh:

Climate change and climatic variability were analyzed in regards to monsoon rice yield in selected areas of Bangladesh. Mean annual maximum temperature has been increased by 0.024°C/year for both drought prone Rajshahi and saline prone Barisal regions from 1971 to 2010 and mean minimum temperature showed a reducing trend for the same period. Maximum air temperature will be more than 35°C in March through May due to climate change in future. Rice crop flowering at such high temperature will be sterile, resulting in severe yield reduction. If maximum temperature increases by 3% i.e. 1°C, wet season rice yield will be reduced by 35% i.e. 0.84 t/ha in Rajshahi areas. Our analyses indicate that minimum temperature is the dominant factor for grain yield reduction in Rajshahi region, whereas rainfall was the influencing factor for yield reduction in Barisal region.

Improving water productivity for different crops in Rajshahi and Barisal regions:

In Rajshahi region, water productivity of wheat and mustard was 13.08-17.12 kg/ha-mm and 4.84-8.22 kg/ha-mm, respectively. Whereas, WP of wheat and mustard was 3.62-8.86 kg/ha-mm and 4.96-7.79 kg/ha-mm, respectively in Barisal region due to delayed crop establishment of dry season crops resulting in low yield and reduced water productivity. Total amount of water used for *Boro* rice was 948-1144 mm depending on locations and WP varied from 3.60 to 5.27 kg/ha-mm. In Rajshahi region, WP of TP and DS *Aus* rice was 7.21-9.23 and 7.64-8.65 kg/ha-mm, respectively. Whereas in Barisal region, WP of TP *Aus* rice varied from 6.65-9.43 kg/ha-mm. The TP rice (monsoon crop) in Rajshahi region WP was 5.55-7.37 kg/ha-mm depending on growth duration. WP of DS *Aman* rice was 4.00-5.71 kg/ha-mm. In Barisal region, WP in *T. Aman* rice varied from 9.18-10.75 kg/ha-mm.

Simulation and application of fibgrow dynamic growth model at impacts of climate change on jute production in Bangladesh: A research program has been conducted for last few years to develop a computer simulation model to assess the climate change impacts on jute production in Bangladesh. Third experiment of the research program presents the impacts of climate change on the jute production in Bangladesh. Jute growth model FIBGROW is used for

the simulation of the fibre yield in climate changes scenarios. Sole effects as well as the interaction effects of prime climatic parameters, solar radiation, maximum-minimum temperatures and concentration of CO₂ are considered in the study. Sixteen treatment combinations of temperature increases (0°C, +1°C, +2°C, and +3°C) and solar radiation changes (0%, +5%, +10%, and -5%) and twenty treatment combinations of CO₂ concentrations (390, 440, 490, 540 and 640 ppm) with the increase in average temperatures (0°C, +1°C, +2°C and +3°C) were considered for fibre yield simulation. Increased fibre yield was simulated for the higher solar radiation and elevated CO₂ concentrations for 1°C increase in temperature but fibre yield decreased for the temperature rise of 2°C and 3°C. Fibre yields were also simulated decadewise climatic variabilities up to the 2100 AD using the climate change prediction scenarios of IPCC and different GCMs. Fibre yields of jute are more or less same up to 2030. Simulated fibre yields for the predicted climate change scenarios showed a clear tendency of decreasing yield after 2030, which eventually falls down to 57.54% at the end of this century.

1.3 Postharvest Technology of Crops

Delay of ripening of guava with chlorination and packaging technique:

The experiment was conducted to evaluate the effect of packaging materials on the quality and shelf life of guava using passive modification of modified atmosphere packaging system. The modified atmosphere was created by making perforation in the polypropylene packets. Guava fruits pre-treated with chlorine water, transporting in plastic crates and then packaging in sealed polypropylene is the best for quality and shelf life for 18 days of storage at ambient conditions considering its physical appearance, marketable quality and change of physico-chemical parameters. Beyond this storage period, rotting and decay of the fruits occurs rapidly, turn into faster softening and ripening, and hence lose marketable quality.

Quality retention in litchi cv. Bomby by postharvest treatments and modified atmosphere packaging:

The experiment has conducted to investigate the effect of ascorbic acid and chitosan and modified atmosphere packaging (MAP) on the shelf life and quality of harvested litchi fruit.. Litchi fruits at commercial mature stage were fully immersed in the solutions of ascorbic acid and chitosan and a mix solution ascorbic acid and chitosan for 10 min, quickly removed the

water from fruit surface by fan and then stored in 0.5% perforated polypropylene packets at 5°C and 90% RH. Mix solution of ascorbic acid and chitosan in combination with MAP delayed pericarp browning and fruit softening, and thus, extended shelf life. The changes in fruit TSS, ascorbic acid, total acid contents and surface colour of fruit treated by the mix solution ascorbic acid and chitosan remained strongly suppressed and consequently extended at least 20 days extra storage life compared to control fruit. Thus, postharvest treatments of ascorbic acid and chitosan with MAP on mature litchi fruits can extend the storage life of litchi up to 24 days.

Effect of postharvest packaging and cool chain management on the quality and shelf life of yard long bean: The experiment was conducted to evaluate the effect of temperature and packaging on the quality and shelf life of yard long bean during transportation and storage. Yard long bean pre-treated with chlorine (200 ppm chlorox/halotab, 2 tablets per 1.5 litre water) water and then transported in corrugated fiber board (CFB) carton maintaining the temperature at 18-22°C and storing in 6°C temperature maintaining 90%RH showed better quality and shelf life up to 15 days of storage. Storage of the yard long bean with proper cool chain management resulted substantial reduction in losses due to physiological weight loss and rotting/shriveling and retained considerable marketable quality as compared to control treatment.

Effect of different packaging techniques on the quality and shelf life of mango cv. Fazli: The experiment was conducted to study the effect of packaging techniques on the quality and shelf life of mango (cv. Fazli). Uniform matured fresh mango was selected and washed with 450 mg/litre 'mancozeb' for preventing microbial infestation. Three types of packets were used for transportation of the mangoes and polypropylene packets (0.034 mm) with different perforations were used to store the mango. Then mangoes were stored at ambient conditions for observation. Physical appearance and physio-chemical parameters was observed and recorded. The obtained result showed that mango transported in plastic crates and kept in 4% perforated polypropylene bag at ambient conditions showed better quality and shelf life up to 12 days of storage followed by wooden box with 3% perforated polypropylene bag and CFB carton with 3% perforated polypropylene bag, respectively in respect to firmness, colour, physiological weight loss,

decay/rotting loss, TSS, acidity, vitamin C and β -carotene content retention.

Baseline survey on postharvest management and value addition of fruits in production catchments in Bangladesh: The present study was conducted to generate data and information along with some baseline indicators on postharvest management of fruits which will be used to assess the impacts of the project. A total of 200 fruits farmers, taking 40 farmers for each fruit were selected for interview by applying simple random sampling technique. Again, 40 farmers cultivating mixed fruits were randomly selected from Khagrachari hill district. The primary data for this study were collected from four fruit growing districts, namely Gazipur for jackfruit, Tangail for pineapple and banana, Chapai Nawabgonj for mango, and Khagrachari hill district for mixed fruits (i.e. mango, banana, and jackfruit) using a pre-tested interview schedule. The study revealed that most of the respondent farmers followed the modern techniques and technologies of fruit production (65%) and used huge amount of growth hormones, pesticides (67.5%), and ripening chemicals (21.7%) indiscriminately. Respondent farmers faced different types of problems related to socio-economics, production inputs, biotic & abiotic stresses, fruit harvesting, packaging, and ripening during production and marketing of fruits. Majority of the farmers (60%) did not process their fruits for value addition and higher income due to lack of awareness and adequate knowledge. Almost all the respondent farmers (97.5%) raised demand for training on postharvest management and processing of fruits for minimizing postharvest loss and value addition for higher income and employment generation.

Effect of blanching on the quality of frozen product of carrot: The influences of blanching on the frozen product of carrots were investigated to determine the quality and shelf life of the products during storage in refrigerator for four months. There were ten treatments using three different blanching time and temperatures. The chemical compositions of the frozen products analyzed. The following results were found: the moisture contents were gradually increased, acidity contents of blanching carrots were decreased and P^H contents increased during storage. The β -carotene contents were increased and the Vitamin C contents were decreased after increasing the blanching time and temperature. On the other hand, the TSS contents were decreased on blanching with long time storage. Peroxidase and catalase inactivation time of enzyme for

steam blanching of carrots represents the most enzymes were inactivated rapidly as temperature rises to 85°C using 2 min blanching time.

Effect of blanching on the quality of frozen product of yard long bean: The effects of blanching on the frozen product of yard long beans were investigated to examine the quality and shelf life of the products during storage in refrigerator for six months. There were eleven treatments using five different blanching times and two temperatures. The chemical compositions were analyzed for the last two months and the following results were investigated: the moisture contents were gradually increased, acidity contents of blanched carrots were decreased and p^H contents were increased during storage times. The changes of β -carotene contents were decreased and the vitamin C contents were decreased after increased the blanching time and temperature. On the other hand, the TSS contents were decreased on blanching with different time and temperatures with the storage times. Peroxidase and catalase inactivation time of enzyme for steam blanching of the beans represents the most enzymes were inactivated rapidly as temperature rises to 95°C using 2 min blanching time.

Standardization of bottling process for sweet corn: The experiment was undertaken to standardize the method for bottling process of sweet corn to enhance the diversified use of corn. Five treatments viz. T_1 (2% Sugar + 0.5% salt+750ppm KMS+0.2g Citric acid), T_2 (2.5% Sugar + 0.5% salt+750ppm KMS+0.2g Citric acid), T_3 (3% Sugar + 0.5% salt+750ppm KMS+0.2g Citric acid), T_4 (3.5% Sugar + 0.5% salt+750ppm KMS+0.2g Citric acid), T_5 (0.5% salt+750ppm KMS+0.2g Citric acid) were used for the experiment. For bottling process of sweet corn, milky stage of sweet corn was processed for blanching at 85°C for 4 minutes. The standard food grade glass bottle was filled with hot pack of whole kernel and closed it manually. Among the observations, the suitable formulation of bottling process was found in treatment T_3 (3% Sugar + 0.5% salt+750ppm KMS+0.2g Citric acid).

Effect of ripening chemical application at different stage of maturity on postharvest quality of tomato: The experiment was conducted to evaluate the effect of ripening chemical application at different stage of maturity on postharvest quality of tomato (*Lycopersicon esculentum*). The tomatoes with various stages of maturity (half ripe, breaker stage, mature green and immature green) were used in the

study for ripening with application of ripening chemical (ethephon @750 ppm) with an absolute control (ripe tomatoes without application of ethephon). The fruits were assessed for physiological changes such as ripening percentage, firmness and pulp recovery, biochemical aspects such as TSS (%), titratable acidity (%), ascorbic acid content (mg/100g), total carotenoids (mg/100g). The data were recorded at 3, 6 and 9 and 12 days after storage. Tomato harvested after maturation showed enhanced ripening process with better quality parameters and increased pulp recovery whereas the immature tomato did not recover 50% pulp at edible stage also. From the experiment it was found that tomatoes harvested at maturity maintains better quality in all aspects though ripening chemical is used for ripening the fruits.

Estimation of whole amino acid in wheat varieties both its and its condition in bangladesh: Grains of four released wheat varieties cultivated under both irrigated timely sown (ITS) and irrigated late sown (ILS) condition were collected from Wheat Research Centre, BARI, Gazipur to evaluate amino acid profile. The four varieties were BARI gom 25, BARI gom 26, BARI gom 27 and BARI gom 28. Amino acid profile was estimated by HPLC using C18 column with UV detector at 254 nm wave length. Sixteen essential amino acids were found in four different wheat grains both ITS and ILS condition comparing with Standard amino acid (PEARCE). In this analysis it was found that Aspartic acid was absent in BARI Gom 27 and Lysine was also absent in BARI Gom 25 in both ITS and ILS condition. When all those four varieties were cultivated under ILS condition Cysteine was not also absent in wheat grain. Only Glutamic acid, Threonine and Proline reached higher chemical score than egg albumin.

Contamination in fruits and vegetables: The experiment was conducted to find out an easy and suitable method for detection of formaldehyde in fruits and vegetables. This method based on spectrometric analysis. Some common fruits (mango and litchi) and vegetables (bitter melon, bitter melon and long yard bean) and one fruit juice (mango juice) were evaluated for formaldehyde detection and quantification. When fruits were dipped in 1%, 5% and 10% formaldehyde solution it did not express any positive effect to enhance self-life of mango and litchi. Formaldehyde was detected in all treatment groups of mango and litchi including their control. Vegetables like bitter

gourd produced 0.9118mg/kg, teasel gourd produced 0.7195mg/kg and long yard bean produced 0.3349mg/kg formaldehyde naturally. Formaldehyde was also detected in mango juice (1.5547mg/kg).

Soils

Project Development and Implementation

Development and coordination of projects are the major responsibilities of BARC. The Soils Unit of BARC is working in line with the mandate of the Council. The Unit oversees the soil fertility and fertilizer management related programs in the country. During 2013-14 the Unit was involved in coordination of four coordinated Sponsored Public Goods Research

(SPGR) Sub-Projects and implementation of one single component Sub-Project under the National Agriculture Technology Project (NATP) funded by the World Bank, IFAD, IDA and GoB. The Member-Director (NRM), BARC worked as the Coordinator and CSO and PSOs of the Unit worked as the Associate Coordinators of the Sub-Projects. Besides, the Unit also looks after the other soil fertility and fertilizer management related single component SPGR Sub-Projects of NATP implemented by different NARS institutes in the country. The SPGR Sub-Projects those are coordinated and implemented by Soils Unit of BARC are as follows:

SPGR Sub-Projects coordinated and implemented by Soils Unit of BARC

Sl. No.	Sub-Project Title	Organization
Coordinated Sub-Project		
1.	Land Productivity and Its Enhancement through Utilization of Surface Water in Coastal Area of Bangladesh	BARC, BARI and SRDI
2.	Carbon Sequestration in Soils of Bangladesh	BARC, BRRI, BINA and BSMRAU
3.	Coordinated Project on Arsenic in Soil-Plant-Water System	BARC, BARI and SRDI
4.	Coordinated Project on Soil Fertility and Fertilizer Management for Crops and Cropping Patterns	BARC, BARI, BRRI, BINA, BJRI, BSRI, SRDI and BAU
Single Component Sub-Project		
5.	Updating of Fertilizer Recommendation through Interpretation of Research Results Generated by the NARS Institutes	BARC
6.	Development of Nitrogenous Bio-fertilizer for Sugarcane with Free-living and Associative Bacteria Using Biological Nitrogen Fixation (BNF) Technology	BSRI

Besides, the following two international projects funded by Asian Food & Agriculture Cooperation Initiative (AFACI) are being implemented under the supervision of Soils Unit of BARC.

International projects implemented by Soils Unit of BARC

Sl. No.	Sub-Project Title	Organization
1.	Agricultural Land Management for Improving Soil Fertility and Irrigation Efficiency	BARC and BINA
2.	Production and Service of Agro-meteorological Information for the Adaptation to Climate Changes	BARC and BUET

Policy Level Contribution

Activity of Fertilizer Technical Sub-Committee

BARC is leading the Fertilizer Technical Sub-Committee. The committee was formed by the Ministry of Agriculture (MoA) in 1997 to help the National Fertilizer Standardization Committee. Member-Director (NRM), BARC works as the convener and Additional Director (Implementation), DAE as the Member Secretary of the committee. The committee comprises of 19 (nineteen) members with the CSO (Soils), BARC, CSOs of Soil Science Divisions of different NARS institutes, CSO, OFRD, BARI; representatives from different concerned organizations like Departments of Environment, Livestock, Fisheries, BSTI, SRDI, BADC, BCIC etc. A plant physiologist from BARI also worked as a committee member for

giving technical support in evaluation of plant growth regulators (PGRs).

During 2013-14, four meetings of Fertilizer Technical Sub-committee were held with Member-Director (NRM) in the chair. A number of organic fertilizers, chemical fertilizers and Plant Growth Regulator (PGR) were evaluated under different stages of procedures. Among them, 15 organic fertilizers were recommended for standardization to the National Fertilizer Standardization Committee headed by Secretary, Ministry of Agriculture.

Research Management and Coordination

Soils unit of Natural Resources Management Division of BARC regularly organizes a Soil Fertility and Fertilizer Management related Research Review and Planning workshop annually. In 2013, the workshop was held during 19-21 November at BARC. The scientific professionals of NARS institutes involved in Soil Fertility and Fertilizer Management Research attended the workshop. Research programmes conducted in the NARS institutes during 2012-13 were reviewed in the workshop. The workshop was divided into seven technical sessions and one recommendation session. The technical sessions were divided into different areas of soil fertility and fertilizer management research and environmental issues. Besides reviewing research programme, the proposed new research programmes designed for 2014-15 were also discussed in the workshop. Scientists from different NARS institutes took part in the discussion, contributed and shared their knowledge, thoughts and experiences for improvement of the programme and to avoid duplication of future programmes.

Monitoring and Evaluation

Soils Unit of BARC is actively involved in the regular monitoring and evaluation programs of BARC. Scientists of Soils Unit worked as the team member of the Monitoring and Evaluation teams formed by the Planning and Evaluation Division of BARC. Member-Director (NRM) worked as the Team Leaders of one monitoring groups formed for monitoring the SPGR Sub-Projects in 2013-14 and monitored the activities of the Sub-Projects assigned for the group. Besides, two Principal Scientific Officers of the Unit also worked as the team members of the monitoring groups and actively took part in the monitoring activities.

Other Activities

Scientists of Soils unit worked as members of the following committees in addition to their regular activities:

CSO (Soils) served as Member Secretary of Proposal Evaluation Committee (PEC) for National and International Consultants under PIU-BARC: NATP Phase-1.

PSO (Soils) served as Member secretary of Tender Evaluation Committee of Procurement of Specialized equipment and logistics by frontier research by NARS Institutes in connection with SPGR Sub-projects under PIU-BARC, NATP Phase 1.

PSO (Soils) served as Chairperson of tender Opening Committee of Procurement of Specialized equipment and logistics by frontier research by NARS Institute in connection with SPGR Sub-project under PIU-BARC, NATP Phase 1.

AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY

Research Management/Financial Management and Coordination

- i) *Potentialities of Major Fruits Farming and Marketing System and Price Behavior in Hill Region of Bangladesh.* Sponsored Project Grand Research (SPGR), PIU-BARC, NATP phase-1.
- ii) *Assessment of Socio-Economic Impacts of Pulses Research and Development in Bangladesh.* Sponsored Project Grand Research (SPGR), PIU-BARC, NATP phase-1.
- iii) *Assessment of Socio-economic Impacts on Oilseeds Research and Development in Bangladesh.* Sponsored Project Grand Research (SPGR), PIU-BARC, NATP phase-1.
- iv) *Consequences of Tobacco Cultivation in Bangladesh.* Sponsored Project Grand Research (SPGR), PIU-BARC, NATP phase-1.
- v) *Marketing and Value Chain System of Brackish Water and Marine Fisheries Products and By-products in Bangladesh.* Sponsored Project Grand Research (SPGR), PIU-BARC, NATP phase-1.
- vi) *Integrated farming and its impact on farmers' livelihood in Bangladesh.* Sponsored Project Grand Research (SPGR), PIU-BARC, NATP phase-1.
- vii) *Comparative Study on IPM and Non-IPM Technology in Selected Vegetables Growing*

Areas of Bangladesh. Sponsored Project Grand Research (SPGR), PIU-BARC, NATP phase-1.

Policy Level Contribution

Different policy oriented comments were sent to the Ministry of Agriculture according to their needs /requirements. Some of those are as follows:

- (i) Comments/Inputs of BARC on “Medium Term Strategy and Business Plan for the Ministry of Agriculture”.
- (ii) Comments of BARC on “1st Working Draft of Bangladesh National Quality Policy (BNQP) for Goods and Services”.
- (iii) Comments/Inputs of BARC on the Change of Base year of Consumer Price Index (CPI) and Gross Domestic Product (GDP) of Bangladesh.
- (iv) Comments of BARC on Statistics Act 2013 of Bangladesh.
- (v) Comments of BARC on *Promotion of Agriculture Trade and Investments among BIMSTEC Member Countries*.
- (vi) Inputs/Suggestions of BARC on *National Work plan (Draft) for Prevention of Violence to the Women and Children*.
- (vii) Inputs for the meeting of 7th Bangladesh-Myanmar Joint Trade Commission (JTC).
- (viii) Inputs/Talking Points of BARC for the 37th Session of the IFAD Governing Council on *Investing in Smallholder Family Farmers for the Future We Want*.
- (ix) Comments of BARC on *National Women Development Policy, 2011*.
- (x) Inputs/Suggestions of BARC on *Import Policy Order, 2015-2018*.
- (xi) Comments of BARC on the *Concept Note on BIMSTEC Poverty Alleviation Centre, Dhaka, Bangladesh*.
- (xii) Comments on the *Provisional Summary Records of the 37th Session of the IFAD Governing Council*.

Monitoring, Reviewing and Evaluation of Programs/Activities of NARS Institutes

Three members monitoring team was formed to observe the progress of the research activities under Research Grant Fund of BARC during 2013-2014 conducted by different research institutes. The team leader and member of BARC was Dr. S M Khalilur Rahman, Member Director (AERS), Dr. Md. Khorshed Alam, PSO(Crops) and Mr. Md. Mustafizur Rahman,

PTO, respectively. This team monitored three projects of BARI and BINA in Rajshahi district.

Another team was formed to observe the progress of the research activities headed by Dr. A.S.M. Anwarul Huq, CSO (AERS), Dr. S. M. Bokhtiar, PSO (Soils) and Mr. Md. Abdul Mottakin, Deputy Director (Estt.), BARC. This team monitored the progress of the seven project activities of BARI, BINA and BAU, Mymensingh in three different locations.

Another three members monitoring team was formed to observe the progress of the four research activities under Research Grant Fund of BARC conducted by BARI and SAU, Dhaka. The team was formed by Dr. Abul Kalam Azad, CSO (Crops), Team Leader, Dr. Monirul Islam, Director (Nutrition), Member and Dr. Md. Mosharraf Uddin Molla, PSO(AERS), BARC, Member.

Highlights of Research Finding

Bangladesh Agricultural Research Institute

BARI 1

Adoption and Profitability of Wheat Varieties in Some Selected Areas of Bangladesh: The study assessed the level of adoption and profitability of wheat varieties at farm level. Data were collected from 600 randomly selected wheat farmers from Dinajpur, Kurigram, Rajshahi, Faridpur, Jessore and Barisal districts. The results indicated that Shatabdi was highly adopted wheat variety (33%) followed by Prodip (29%), Bijoy (12%), BARI Gom-26 (11%) and BARI Gom-25 (8%). BARI Gom-24 (Prodip), BARI Gom-21 (Shatabdi) and BARI Gom-23 (Bijoy) covered 53%, 23% and 16% area of land in 2012-13. The area under Prodip, Bijoy, BARI Gom-25 and BARI Gom -26 varieties of wheat are gradually increasing and the area under Shatabdi, Protiva, Sourov and Sufi varieties are decreasing year after year. The adoption level of sowing time and irrigation were high. The adoption level of manures was low and the adoption level of urea, TSP and MoP were high. BARI Gom-26 variety produced the highest yield and gave higher net return than other varieties of wheat. The benefit cost ratio of BARI Gom-25 was highest (1.49). The net return of wheat was higher than its competing crops like lentil and mustard and lower than potato, maize and boro rice. Human labour, seed, urea and TSP had positive and significant effect on wheat cultivation. Non-

availability of new variety seed at proper time and lack of technical knowledge about improved cultivation practices were the major constraints of wheat cultivation.

BARI 2

Export and Import Parity Analysis of Selected Vegetables and Spices in Bangladesh: The study was undertaken to find out export potentialities of selected vegetables and import substitution of selected spices in the country. A total of 480 vegetables (40 for each vegetables and each location) and 240 spices growers (40 for each location), 25 suppliers and 25 exporters were randomly selected for the study. Cost and return analysis was done on both variable and total cost basis. Domestic resource cost (DRC) was also estimated for evaluating the comparative advantage of selected vegetables and spices. The study revealed that the net margins of producing vegetables and spices were found positive. However, higher net margin was estimated for brinjal producers (Tk 2,73,799/ha) followed by ginger producers (Tk 2,31,399/ha). Comparatively low net margin was calculated for potato producers (Tk 59,758/ha) than garlic producers (Tk 99,352/ha). Again, higher net margin was calculated for vegetables exporters of Tk 33,935/ton at UK and Tk 23,952/ton at Middle East markets followed by vegetables suppliers (Tk 2,437/ton). The highest benefit cost ratio was for ginger (2.1) followed by brinjal (1.9), ash gourd (1.8) and cucumber (1.7). The estimates of DRC showed that Bangladesh had comparative advantage in bitter gourd, pointed gourd, ash gourd, cucumber, brinjal and potato production as these estimates were less than one and DRC for onion, garlic and ginger were also less than unity implied that the production of these spices would be highly efficient for import substitution.

BARI 3

Betel Leaf Cultivation and Marketing for Sustainable Income in Bangladesh: The study was conducted in four betel leaf growing areas namely Barisal, Chittagong, Rajshahi and Kustia district during 2013-14 to assess the physical productivity, profitability and to explore the constraints to betel leaf cultivation. The findings of the study revealed that betel leaf cultivation was profitable in the study areas, although BCR in the first and second years was below one due to high investment cost. Gross return of betel leaf cultivation was highest in the fifth year. Highest yield received by the farmers also in fifth year. The benefit cost ratio was found highest in 6-10 year followed by 5th and 11-15 year. The benefit cost ratio at

12%, 15% and 20% rate of interest were 1.27, 1.25 and 1.21 respectively. IRR was calculated 62% in current situation, IRR 37% was found by 10% decrease of return and 39% by 10% increase of cost. Farmers faced some constraints like leaf rot disease, high price of boroj materials, vine died, lack of capital, low price of betel leaf, high price of oilcake, non-availability of modern variety etc.

BARI 4

Farm-Level Study of the Pesticide Use on Brinjal in Different Areas of Bangladesh: The study has been conducted in Jessore and Comilla districts. A total of 60 farmers, 30 from each district, were selected randomly. All the respondent farmers were found to have used pesticides. It was observed that most of the farmers' deep rooted notion was that there is hardly any production without using pesticide. As many as 23 and 14 types of pesticides were used by the farmers in Jessore and Comilla districts, respectively to control all the insect pests. For controlling brinjal shoot and fruit borer, farmers used 12 and 8 types of pesticides in Jessore and Comilla, respectively. The farmers of Jessore used excess pesticides and mixed two or three pesticides together to apply what they call 'cocktail'. The highest number of farmers used voliam flexi in both Jessore and Comilla districts. The farmers of Jessore incurred a huge amount of money (Tk162,652/- per hectare) for controlling shoot and borer insect, which had a wide gap in terms of money invested for controlling other insect pests both in Jessore and Comilla. Farmers of Comilla incurred only Tk21,491/- per hectare for controlling brinjal shoot and fruit borer. Total amount of pesticide application in hectare per farmer for controlling shoot and fruit was 4808 ml and 1351g pesticides in Comilla, 23255 ml and 15111g pesticides in Jessore. The average success of applying all the pesticides to control insect pests was more or less ranged from 60% to 100%. In the case of brinjal shoot and fruit borer, they never had 100% success. Not a single farmer was found having any idea about pre-harvest interval of the pesticides. Most of the farmers opined that they give emphasis to have shiny, fresh, spot free vegetable in order to get higher price; that is, health is the secondary issue for them. With respect to choice and fixing the dose of pesticides, farmers are largely dependent upon the suggestion of the dealers, which might lead the farmers of being deceived as the dealers have commercial motive. For judicious use of pesticide and the knowledge on pre-harvest interval of pesticides, training of farmers, SAAO as well as dealers are essential. Ethical

motivation of the farmers, bio-rational method of controlling insect pests etc should be ascertained with a view to having toxic free fresh food for long healthy human life.

BARI 5

Study on Rural Households' Food Security in Coastal Region of Bangladesh: The study focused on the status of food security and its determinants among coastal households during 2011-13. It also identified their livelihood risks and coping strategies during stressed situations. A total of 1350 households were randomly selected from nine coastal districts namely Khulna, Bagherhat, Satkhira, Barguna, Patuakhali, Bhola, Noakhali, Laxmipur and Cox's Bazar for this study. The study revealed that most of the households (53%) were food secured whose calorie intake (2753kcal/capita/day) was much higher than the national average (2318 kcal/capita/day). Among various food items, rice supplied 72.96% of the total daily calorie intake of the food secured households followed by edible oil (6.47%), fish (6.14%), potato (3.20%), and other vegetables (2.27%). Logit regression model revealed that farm size, farm income, off-farm income, and household crop production had positive and significant impact in attaining food security of the coastal households. Besides, small households and the households with more earning member were more food-secured than large ones. Flood, heavy rainfall, salinity problem, reduction of land productivity, lack of modern technology, crop damage by rat, and high price of inputs were found to be livelihood risks for the coastal households. They borrowed money from relatives or others, sale of poultry, sale of livestock, use previous savings, sale of own assets, sale of labour, fisherman, received help from various institutions, moved elsewhere to find work, and reducing adult consumption to provide for children during different stressed situations.

BARI 6

Impact of Specialized Agricultural Credit Policy on Spices Production: Specialized Agricultural Credit (SAC) policy implemented by the Bangladesh Bank played a significant role to increase agricultural production specially spices. Impact and performance of SAC policy on spices production was assessed in this study. This study captured impact of credit on onion farmers of Faridpur and garlic farmers of Natore district. The survey was conducted on 200 farmers of which credit recipient farmers were 50 and non-recipient farmers were 50 from each districts. The

study revealed that only 6% farmers of a village received credit for spices production at 4% interest rate. Credit recipient farmers received on an average Tk. 26,255. Due to getting credit facility farmers increased 16 decimal of cultivable land for spices cultivation, increased number of spices crop for cultivation, increased amount of input use with better quality. For these, credit recipient farmers harvested spices with higher yield, which finally helped to increase farm income. Based on farmer's experience of getting credit facility, it was revealed that the performance of spices credit with lower interest rate facility was a good facility for the farmers to increase spices production in Bangladesh. Farmer's age, number of spices cultivated, distance of bank from farmer's home, farmers personal acquaintance with bank officials and good relation with bank officials were found positive and significant effect on the probability of accessing credit. Credit recipient farmer's received higher net return from onion and garlic cultivation. Highest percentage of farmers (82%) mentioned lack of information about spices credit was a main reason behind not getting credit facility. Specialized credit facility for farmers need to be widen through spreading information of spices credit facility among the farmers and increasing amount of credit.

BARI 7

Postharvest Loss Assessment of Vegetable in Some Selected Areas of Bangladesh: The study has examined the nature and extent of postharvest losses in vegetable in the Narshingdi, Jessore, and Bogra districts. Multistage sampling technique has been used for selection of 270 vegetable growers and intermediaries, out of which 15 farmers and 15 intermediaries from each district for each vegetable selected randomly. Three major vegetables namely potato, brinjal, bitter gourd were selected for the study. Descriptive statistics was used to estimate the postharvest losses at different stages and a multiple linear regression model was carried out to estimate the factors affecting postharvest losses at farm level. The major postharvest practiced by the farmer and intermediaries were harvesting, grading, packaging, storing and transporting. The aggregate post-harvest losses in sample vegetables were calculated by taking together losses at farmer level, Aratdar, level Bepari level, and retail level. Postharvest losses were maximum in brinjal (23.38%), followed by bitter gourd (17.97%) and potato (16.73%). Across different levels it was found that the losses were maximum at the grower level in all the vegetables. It was observed that at grower's level the highest losses was found in brinjal

(12.51%) followed by potato (9.59%) and bitter gourd (9.53%) respectively. Across different intermediaries levels, it was found that the losses were maximum at the retail level in all the vegetables. It was found that brinjal (5.96%) losses was maximum at retail level followed by bitter gourd (4.35%) and potato (3.61%) respectively. In Aratdar level losses potato (1.53%), brinjal (2.35%), and bitter gourd (1.86%) respectively. In Bepari level losses potato (1.63%), brinjal (2.65%), and bitter gourd (2.23%) respectively. Some important factors such as farming experience, sale price, transportation dummy had negative and total production and weather dummy had positive and significant relationship with the total postharvest loss of vegetable. Absence of postharvest treatments, low market price, lack of available storage facilities, and poor and costly transportation were the major problems at farm and intermediaries level. Proper storage facilities, easy transportation, applied scientific method of harvesting and fair price policy suggested by the study to minimize the postharvest loss.

BARI 8

Economics of Sweet Potato Cultivation in Bangladesh: A Farm Level Study: The study was conducted in two districts namely Comilla and Jamalpur to assess the socioeconomic status of sweet potato farmers; relative profitability of sweet potato; factors influencing sweet potato production; and problems of sweet potato cultivation. A total of 120 sweet potato farmers taking 60 from each district were selected randomly for the study. Data were collected through a pre-tested interview schedule during February-March, 2014. Both tabular and functional analyses were applied in this study. Costs and returns analysis revealed that the total costs of sweet potato cultivation was Tk. 9,34,304 per hectare. The average yield of sweet potato was 16.7 tons per hectare. Per hectare net returns from sweet potato cultivation were Tk. 72,597 in Comilla and Tk. 90,981 in Jamalpur district. About 30% farmers showed positive attitudes towards sweet potato production in the next growing season which were due to higher yield, low cultivation cost, high profit, and needs less labour. Although sweet potato was a profitable crop, due to some drawbacks many farmers showed negative attitudes towards sweet potato production. Functional analysis revealed that cost of human labour, vain cost, manure, education, and experience in farming had positive and significant effect on the gross return of sweet potato production. Farmers could not use inputs efficiently in sweet potato production. The major problems and constraints for

sweet potato cultivation were scarcity of HYV seed, lack of credit facility, scarcity of vain, lack of storage facility, and higher input cost.

BARI 9

Existing Marketing System and its Opportunities of Groundnut Production in Charlands of Bangladesh:

The study was undertaken to examine the input use pattern, relative profitability, marketing system, marketing cost and margin, production and marketing problems of rabi season groundnut in char lands of Faridpur, Jamalpur, and Kishoreganj districts of Bangladesh. The sample size of the study was 225 including 90 groundnut farmers and 135 traders. Highest (56%) groundnut farmers cultivated Dhaka-1 variety and only 23% farmers cultivated BARI chinabadam-8. The study revealed that, per hectare production cost of groundnut was Tk.61,547, net return was Tk.42,033 and BCR was 1.68. The result of partial budgeting analysis showed that if farmers cultivate groundnut instead of its competitive crops like sesame and wheat, they will get Tk. 24,445 and Tk.21,990 as an extra profit. On the other hand, the net change of benefit of groundnut cultivation with potato is negative which indicates that groundnut cultivation is not profitable in Kishoreganj district. Major five marketing chain were identified on the basis of product flow in the study areas. The average estimated per quintal marketing costs incurred by different actors were Tk.102 for Faria, Tk.357 for Bepari, Tk.55 for Aratthdar, Tk.112 for Paiker, Tk.128 for Retailer and Tk.1388 for Stockiest per quintal. Per quintal net marketing margin was Tk.231 for faria, Tk.310 for Bepari, Tk.59 for Aratthdar, Tk.1212 for Stockiest, Tk.225 for Paiker and Tk.306 for Retailer. The major problems of groundnut production were lack of irrigation facilities (34%), low rate of germination (31%), and lack of cultivable land (29%). Major marketing problems reported by the intermediaries were lack of cash capital (82%), lack of storage facilities (55%) etc. Arrangement of institutional credit with low interest rate (80%), Collateral free credit (45%), and arrangement of storage facilities (72%) were the trader's opinion to minimize the marketing problems.

BARI 10

Financial Analysis of Radish Production in Some Selected Areas of Bangladesh:

The study was proposed to gain an in-depth understanding the financial analysis of radish growers of the four selected areas. 150 samples were randomly selected from

Bogra, Chittagong, Jessore and Norsingdi areas. The main objective of the study was to determine the factors which inclined the farmers to cultivate radish as major crop. Tabular, graphical and statistical methods were applied to analyze the results. Multiple regression model was used to determine the factors of productivity. Most of the farmers were educated at primary and secondary level. Agriculture was the main sources of income for the respondents. Family size of the respondent was higher than that of national average. Average age of the respondents was 44 years. Farmers of the Chittagong areas cultivated HYV of radish while the farmers of the others areas cultivated local varieties of radish. The farmers were more dependent on SAAO than BARI support. The Chittagong farmers incurred higher amount of cost than that of other areas. Norsingdi farmers got higher yield than that of other areas. Due to market price, Chittagong farmers got higher income through radish cultivation. Human labour was the major cost item in every area. Is it more than 60 percent in Chittagong area and more than 40 percent in other areas. Fertilizers were the next costly input to farmers. Though, the farmers used lower quantity of fertilizer than recommended dose. The farmers used higher quantity of human labour to the production chain of radish. Higher price of radish had a chance to get higher income. Quality seeds and technology can reduced the cultivation cost of radish. The farmers faced insect and disease problem in cultivating radish like stem, rot, leaf spot, hollow heart disease etc. Radish cultivation was profitable and it can be increased through boosting up productivity.

BARI 11

Marketing and Value Chain Analysis of Garlic: A Study in Selected Areas of Bangladesh: The study was undertaken to determine price fluctuation, marketing system, marketing cost, margin, efficiencies and to examine the value chain of garlic aiming to determine the value addition in different steps of garlic marketing channel. Primary and secondary data were used for this study. Secondary data were collected from various published sources for the period of 1985/86 to 2011/12 for time series analysis. Primary data were collected from Dinajpur, Natore and Rajbari districts depending upon the concentration of production and commercially marketing of garlic and consuming area Dhaka and Bogra. A multistage randomized sampling procedure was used in selecting 120 farmers, 36 farias, 45 beparies, 15 aratdars, 30 wholesalers and 30 retailers. Data were analyzed using simplest method for

fluctuation, marketing margin, profit and efficiency ratio, and value addition. The study showed that the extent of annual price fluctuation of garlic was identified which was between -55 to 173 percent while the extend of fluctuation of area, production and yield ranged between -14 to 46, -18 to 73 and -5 to 18 percent respectively during the study period. Four major marketing channels were identified for domestic produced garlic marketing. Channel-3 was the most important supply chain through which 40% domestic produced garlic reaches to consumers. Marketing costs for each 100 kg of garlic were estimated from Tk 86.82 to 388.28 and marketing margin Tk 546.19 to 1474.72, respectively for different intermediaries. Marketing margin and profit were the highest in retailer than those of other intermediaries. The study showed, out of four marketing channel, Channel-2 was more efficient than those of other channels. Six actors like; farmer, faria, bepari, aratdar, wholesaler, retailer and consumer are identified who are involved in the garlic value chain. The study revealed that retailer added highest amount of value Tk 1474.72 per 100 kg garlic followed by producers (Tk 877.15), bepari (Tk 676.60), Faria (Tk 559.16) and wholesalers (Tk 1474.72) respectively. Eleven marketing problem were identified, among them price fluctuation, high transport cost and lack of loan facilities were the major problem. It is therefore, recommended that loan facilities should be provided to the intermediaries and transportation cost should be keep reasonable.

BARI 12

Opportunities of Fallow Land Utilization through Sorjon Cultivation Technique in Some Selected Coastal Areas of Bangladesh: The study was conducted for the assessment of profitability, farmers' attitude and constraint to fallow land utilization in three coastal districts namely Patuakhali, Jhalakathi, Pirojpur was made through an extensive field survey during 2013-2014. The study revealed that farmers of these areas cultivate crop on plain only one to two times. In the study area farmers get average BCR (TC) of 1.72 cultivating crop on Sorjon and get a BCR (TC) of 1.28 cultivating crops on plain land per year. Farmers get higher return on Sorjon than on plain land. Major constraints to fallow land utilization is high depth of water on cultivable land during kharif-1/Aus season, late sowing (July-Mid August) of T. Aman as well as late harvest (November- Mid February), late joe condition of soil due to stagnant water on land etc. Labour crisis, Irrigation problem, Low price of harvest, high price of agricultural inputs, Disease infestation,

Insect attack were found to be the major problems in the study areas for both plain land and Sorjon farmers.

BARI 13

Adoption and Profitability of Summer Tomato Cultivation in Jessore Region: The study assessed the level of adoption and profitability of summer tomato varieties at farm level. Data were collected 90 randomly selected tomato farmers of Bagherpara upazilla, Jessore sadar and Jhikorgacha upazilla of Jessore district. The results indicated that BARI hybrid tomato-4 was highly adopted summer tomato variety (75) followed by 16 % was BARI hybrid tomato-8 and only 9 % was ACI summer king. The adoption level of ploughing, manure and fertilizer use were low, whereas planting time and irrigation were high. Total cost of production of summer tomato was 584822 tk/ha where as 507355tk/ha is variable cost and fixed cost is 77467 tk per hectare. Among the cost item mancha preparation cost is the high, almost 26.89 % and 26.10 % cost is labor cost of production. The average yield of summer tomato was 50.41 t/ha and gross return was 1542300tk/ha. On the average, benefit cost ratio was found to be 2.64 on full cost basis and 3.04 on cash cost basis. Marketing cost of summer tomato of a farmer was 683 tk/ton. Human labor, seed, fertilizer, hormone and irrigation had positive and significant effect on summer tomato cultivation. Attack by pest and disease, lack of seed at proper time, lack of agricultural credit and high cost of production were the major constraints for the adoption of summer tomato. The farmer had no marketing problem in the study area due to high demand of tomato in this season.

BARI 14

Socio-economic Impact of BARI Sarisha 14 in Jamalpur District: The study assessed the socioeconomic impact of BARI sarisha 14 at farm level. A total of 60 primary data collected from Jamalpur district randomly for the study. Maximum of the BARI sarisha producing farmers in the study was illiterate, small size land holder and maximum (30%) sampled farmers were under the age group category 28-37 years. The total cost of BARI sarisha 14 cultivation was 33013 Tk/ha. The average yield of BARI sarisha 14 948 Kg/ha. Per hectare net return was 9547 Tk/ha. BARI sarisha 14 production was found profitable as benefit cost ratio was 1.29. The application of human labour should be reduced to get better return from BARI sarisha 14. Farmers should be trained enough about scientific and efficient management of production for more profitable.

Bangladesh Rice Research Institute

BRRI 1

Farm Level Evaluation of Modern Rice Cultivation in Bangladesh: BRRI dhan28 and BRRI dhan29 were the most popular varieties in Boro season covering 39 and 25% of the Boro rice area, respectively. BR11 is still the dominant variety in T. Aman season covering about 22 percent of the total area. In Aus season, area coverage of BRRI dhan28 was the highest (12 %) followed by BR2 (7 %). Among different BRRI varieties, BRRI dhan29 was the top yielder in both Boro (5.43 t/ha) and Aus (4.96 t/ha) seasons. BRRI dhan32 ranked the top position in terms of per unit yield (5.21 t/ha) in T. Aman season. Recently, Hybrids are being adopted as replacement of other MVs in Aus and Boro seasons due to higher yield performance.

BRRI 2

Estimation of Costs and Return of MV Rice Cultivation at Farm Level: Rice farmers used more seed than the recommended dose irrespective of cropping seasons. They applied comparatively lower amount of TSP and MP fertilizer may be due to ignorance. MV Boro growers obtained higher yield because of better cropping environment, good management practices and use of better genotypes. However, the net return was higher in Aman production owing to lower costs of production and better market price compared to Aus and Boro, respectively.

BRRI 3

Varietal Release Pattern and Variety Specific Adoption in Bangladesh: An Application to New Approach of Adoption Study: Rice varietal development remains to be skewed in favor of Aman season as 46 percent of 72 MVs released up to 2010 were Aman. High-yielding, good eating quality, short duration, insect/disease resistance, high milling recovery and high grain weight, etc were the major traits in selecting the rice varieties. . Expert elicitation method provided estimates of varietal adoption which were highly congruent with the household survey estimates. In addition, it is cost-efficient and time-saving; therefore, it may be a good alternative to monitoring and evaluating the varietal adoption status at the field level.

BRRI 4

A Simulation Study on Impact of Climate Factors on Production and Requirements of Rice in Bangladesh: Results of simulation study revealed that

considering the climate factors; although, the yield and area of local varieties of Aus, Aman and Boro is decreasing, but total production of rice is increasing due to higher yield of those modern varieties. Higher level of per capita income growth along with negative elasticity of demand of rice leads to the diversification of consumers' food habit.

BRRI 5

Supply of and Demand for Agricultural Labour in Gazipur District: Evidences from Farm Level Investigation: Level of income and family labor supply is inversely related. Poor people supply less labor with the increase of income and technological advancement. The demand for agricultural labour goes up due to higher labour intensity of MVs, putting an upward pressure on the wage rate. Enhancing small and medium scale mechanization, motivating the inactive household labor for working in own field, and reaching latest suitable technology to the doorstep of the ultimate users might mitigate the labour crisis to some extent.

Bangladesh Livestock Research Institute

BLRI 1

Fodder production and marketing system in some selected area of Bangladesh: The study reveals that the production cost of fodder for producer was estimated the highest (Tk 1,87,598/ha) in Kurigram district and the lowest (Tk 1,71,883/ha) for producer cum seller in Kurigram district. The bio-mass yield estimated was the highest (214.05 t/ha) for producer in Dinajpur district and the lowest was (201.45 t/ha) for producer cum seller in kurigram district. Annual net return from fodder production was estimated the highest (Tk 2,12,272/ha) for producer cum seller in Jessore district and the lowest (Tk 1,29,806/ha) for producer cum seller in Kurigram district. The BCR was estimated the highest 2.18 for producer cum seller in Jessore district and the lowest was 1.75 for producer cum seller in Kurigram district. The estimated coefficient of the variable Fodder sale, Livestock sector and Fodder business were 0.472, 0.312, and 0.770 respectively and were significant at 1% level of confidence with positive sign. The dairy owner having 1-2 cross-bred dairy cattle earned Tk. 1,50,720 as the highest income in Jessore, 3-4 cross-bred dairy cattle earned Tk. 2,05,200 as the highest income in Kurigram and 5-6 cross-bred dairy cattle earned Tk. 5,02,000 as the highest income in Jessore (Table-4). In the study areas, surplus green fodder was sold in the market. The fodder was sold either in bundles or weight basis. For

marketing of fodders, various marketing channel are operating. The main channels are: (i) Producer-Dairy owner and (ii) Producer-Fodder Middleman-Dairy owner. There were problems related to fodder production in the study areas was lack of HYV fodder species, lack of knowledge for fodder cultivation, lack of suitable land availability, lack of technical knowhow, lack of adequate fodder scientist, lack of input facilities (i.e. fodder cuttings, irrigation, fertilizer, hire labour), scarcity of marketing facilities and fodder markets are unorganized and unregulated. Based on those problems the following needs to be taken into consideration: Supply of HYV fodder, Provide training on fodder cultivation and preservation technology through visual and audio visual methods, availability of more milk producing cattle breed, disseminate scientific cultivation practices of fodder and post-harvest technologies (i. e. Silage, hay etc) and create organized marketing structure in surplus fodder production areas.

BLRI 2

Impact assessment of GO-NGO interventions on dairy farming vis-à-vis self-managed dairy farming in a selected area of Bangladesh: Productivity and profitability of supported dairy farming were higher than the self-managed due to intervention. Both self-managed and GO-NGO supported dairy farmers were profitable in dairy farming but they have scope to attain full efficiency in milk production by reallocating their existing resources. GO-NGO supported farm created greater opportunity for employment of both male and female than self-managed. Income from almost all sources was increased due to such NGO intervention and income from livestock rearing increases at a higher rate than from other sources. As income as well as expenditure on own consumption increases due to intervention, overall livelihood status of dairy farmers was improved.

COMPUTER AND GIS

Computer and GIS unit of BARC plays a vital role to facilitate ICT and MIS related activities/services among NARS institutes through establishment/strengthening of ICT infrastructure for ensuring information availability, accessibility, dissemination etc. The activities of the unit also involved in preparing technical specification of procuring computer hardware, software, networking and related goods/accessories, evaluating technical proposal, receiving ICT goods, distributing them among officers

and staffs. The unit also provides support for troubleshooting of hardware, software, network, internet/email and related services. In addition to that, the unit conducts various ICT training for the scientist, officer and staff that helps in capacity building of BARC and NARS institutes through ICT enabled human resources. The unit also provides assistance for evaluation of research program in the field of ICT and in recruiting of computer professionals and staffs in BARC and NARS institutes. Besides, the unit conducts a lot of other activities such as progress report on ICT activities, need assessment, review of research proposal etc. Personnel of the unit are also working as innovation officer and member of WIT of BARC formed under Governance Innovation Unit (GIU) of Prime Minister's Office.

Geographic Information System (GIS) is another important functional part of the unit. Maintenance, necessary updating and output preparation of AEZ land resources database and local level Upazila Nirdeshika Database (soil, land, nutrition and others) is an on-going activity of this unit. Land suitability assessment and crop zoning was an important outcome of GIS activity.

With the support of National Agricultural Technology Project (NATP) phase-I, Computer and GIS unit established a Data Center at BARC which connects 7 NARS institutes through Virtual Private Network (VPN). The development of MIS for NARS is in progress with NATP support. During 2013-14, MIS has been deployed at BARC Data Center as well as in the servers of 7 NARS institutes. Data input, MIS software validation etc. are going on at each organization towards making the MIS fully operational. The MIS system once operational will help managing human resources, identify skill gap, observe research trend in different sub-sector of agriculture, avoid wasteful duplication, maintain account and budgetary system, procurement, among many other advantages. The unit has also been providing continuous strategic and technical support in establishing the Digital Display Center (DDC) at BARC. Also involved in preparation of ICT need assessment of NARS for NATP, Phase-II etc. The major activities accomplished during the period are as follows:

Establishment of MIS-ICT facilities at NARS

The main responsibility under this activity was to provide required support for the development and deployment of MIS (9 modules) at BARC and NARS

institutes. The MIS has already been installed in 7 NARS institutes and BARC. During this period:

- attended series of meetings arranged by PCU, NATP for validation and finalization of Business Requirement Document (BRD) and Software Requirement Specification (SRS) document of MIS and provided important feedbacks on the development of MIS;
- provided support to MIS development firm (Techno Vista Ltd.) in deploying the MIS at 7 NARS institutes and BARC Data Centre. Coordinated activities among Network and Hardware supplier firm, MIS development firm and NARS institutes for installation and configuration of MIS modules and prerequisite software (Redhat Linux, Apache, MySQL etc.) at BARC and NARS institutes. Facilitated availability of remote server access from the office of MIS development firm to BARC Data Centre through TeamViewer client;
- provided support to PCU for arranging training program on MIS module's general user training, specific user training, technical training etc. The training was imparted by the personnel of MIS development firm. Personnel of different disciplines of BARC and NARS institutes participated in the training programs;
- supervised data entry and verification activities of MIS development firm.

Application of GIS for farm productivity enhancement through land suitability assessment of major cropping pattern of Bangladesh (SPGR Sub-project)

The major activities of the project (i) baseline survey and (ii) development of GIS-based land suitability assessment software has been completed. During the project period land suitability assessment of 15 (fifteen) upazila has been done. The land type maps of 15 (fifteen) upazila produced from the software were validated in the field. A training was organized on the crop suitability assessment model (CSAM) software. Twenty participants from BARC and NARS institutes participated in the training. A mid-term workshop and meetings were organized during this period. The project completion report (PCR) has already been submitted to PIU-BARC which will be printed after clearance from PIU-BARC.

Establishment of Agricultural technology information network in Asia

During this period e-content of agricultural production technologies of several crops were developed and

uploaded to AFACI website. Also, preparation of crop calendar for 5 (five) crops boro, aus and aman rice, wheat and mustard are at the final stage. A book titled “Handbook of Agricultural Technology” published under this project were distributed to upazila, districts, divisional offices of DAE, research institutes, universities, NGOs etc. As an important activity of the project an annual evaluation workshop of AFACI projects in Bangladesh has been organized during this period.

Strengthening simulation approaches for understanding, projecting and managing climate risks in stress-prone environments across the central and eastern Indo-Gangetic Basin (Climate Smart System Simulation (CSSS)-Bangladesh component

The study was a component of the AgMIP (Agricultural Model Inter-comparison and Improvement Project) Indo-Gangetic Basin Project, which focuses on cereal crop production regions in the Central and Eastern Indo-Gangetic Basin. Climate, benchmark soil, crop cultivar, and field survey data of 50 farmers are assembled for a set of crop models and AgMIP protocols are followed to simulate current and future climate risks. The goal of the project was to make a lasting contribution to methodologies for adapting agricultural systems to current and projected climate risks in South Asia, in particular attention to Bangladesh. The effort was made to answer the following key research questions:

1. In what ways climate change will impact agricultural production systems?
2. Can climate change vulnerabilities be reduced through adaptation?
3. In this study, APSIM and DSSAT based simulation models for two crops rice and wheat were used for inter-comparison.

Twenty GCMs data were generated for RCP 8.5 (2040-2069, Mid-Century) time period. Five sets of climate data namely-IEXA, IIXA, IKXA, IOXA, IRXA for the median future scenarios were chosen for conducting the crop simulations. For RCP8.5 Mid-Century 2040-2069 scenarios CO₂ concentration was set at 571 ppm. Model intercomparisons were made for two wheat models (DSSAT-CERES-Wheat and APSIM-Wheat) and two rice models (DSSAT-CERES-Rice and APSIM-Rice) with a data set for one location (Dinajpur). The integrated assessment conducted to answer the following questions:

1. What is the sensitivity of current agricultural production systems to climate change?
2. What is the impact of climate change on future agricultural production systems?
3. What are the benefits of climate change adaptations?

A stakeholder workshop with the participation of expert and other relevant professional was organized during this period.

Capacity enhancement of NARS through ICT-based Agricultural Research Management Information System (ARMIS) project

During 1st phase (July 2013 to March 2014) of the project, manpower recruitment, necessary procurement was done. Also, ARMIS software has been developed and NARS personnel trained on the software. In this period, 6033 complete research information and 1637 partially complete research information i.e. total 7670 entries have been inputted into the system. Initially data for 2002 to 2012 have been captured from 16 organizations (13 NARS and 3 Agriculture universities). In the next phase, more agriculture related organizations like research institutes, universities, GO-NGOs, private sectors and international organizations etc. will be included. The research information of different organizations since their inception will be entered into the database. During the period 2 (two) workshops, 6 (six) trainings and series of field visits and meetings were organized.

Maintenance and Updating of BARC Website

The work is being carried out as a routine job. However a new dynamic, bilingual (Bengali and English version) state-of-the-art technology website of BARC has been developed through outsourcing. The new website will be launched soon. During this period BARC website has been moved to new ISP with more space and usage bandwidth, multiple database support, increased email account facility etc.

Design and development of BTRI and BSRI website

This activity could not be done due to non-availability of fund.

Server and Network administration and Internet/Email management

System Administration for smooth functioning of LAN and Internet/Email service has been done as a routine activity. During this period, for smooth operation of network and internet/email system, necessary support and maintenance has been provided.

During this period, the ownership of 1 Mbps leased internet line from BTCL transferred from Tech Valley Ltd. to BARC.

Data Centre Operation

Supervise the functioning of hardware, software and network system for smooth running of Data Centre to facilitate MIS implementation at BARC and 7 NARS institutes. This activity is very vital in the context of data transfer from NARS institutes to the respective MIS databases housed at BARC data centre. The proper functioning of data centre will serve various users with their information requirement while searching/querying the MIS databases.

Climatic database

The daily climate data (temperature, rainfall, humidity, sunshine, wind speed, cloud coverage) of 2009 and 2010 were collected from BMD and necessary processing has been done. Accordingly, monthly and historical average data uploaded to BARC website. The climate data for the year 2011 to 2013 has also been collected from BMD. The data will be uploaded to the website once necessary processing is done.

Maintenance and updating of existing database

- **PMIS Database with BARC Personnel (followed PDS format of MoA):** Personnel Management Information System (PMIS) has been developed to incorporate the PDS requirement for the personnel of BARC and NARS institutes. Information on general, education, training, job history, publication, achievement, leave information etc. are incorporated into the system. The system can accommodate personnel information of 13 NARS organization's officers and staffs. Already a significant progress has been made in terms of data entry from BARC, BSRI, BSRTI, BRRI and BJRI into the system.
- **Inventory Management System of BARC:** During this period, in order to build up online inventory management system with store management, PHP-MySQL based application has been developed.

Development of Payroll System

The payroll system for monthly salary generation has been completed. Salary data of BARC personnel from September-2013 to January-2014 has been entered into

the system. The software has already been delivered to the finance unit for use.

Continuation of GIS Activities

- Maintenance and output preparation of Upazila Nirdeshika Database
- Maintenance and output preparation of AEZ Land Resources Database
- Maintenance, necessary updating and output preparation of AEZ land resources database and local level Upazila Nirdeshika Database (soil, land, nutrition and others) is continuing as an on-going activity. Crop zoning work is a part of this activity.

Support to BARC and NATP as PEC and TEC member

Necessary support has been provided to BARC and NATP for procurement of goods, works and services. Also involved in various recruitment at different organizations/projects.

Support to Division/Sections of BARC for Hardware / Software

Support provided to different divisions/sections to fix various types of computer hardware and software problems. Several types of maps, land resources, climatic and other data have been provided to scientists/researchers/extensionists as per requirement.

Support for planning, budgeting and procurement of computer resources

Support provided in the form of requirement assessment, specification preparation, budgeting for procurement of computer hardware, software and accessories under BARC and different projects i.e. ARMIS, NATP and KGF.

Field monitoring of programs/activities

As a team leader of monitoring team formed by Planning & Evaluation division of BARC, Md. Abeer Hossain Chowdhury, Director, Computer & GIS unit monitored the implementation progress of core research programs (i) *Adaptation of heat tolerant tomato and Photo insensitive country bean variety during summer season in Sylhet region* and (ii) *Development of artificial breeding techniques of Sperata aor* under BARC research grant at Moulvibazar.

As Principal Investigator of SPGR GIS sub-project Md. Abeed Hossain Chowdhury, Director, Computer & GIS unit visited Tanore upazila of Chapai Nawabganj district to monitor the field level activities of the project conducted by CEGIS.

Also, Mr. Shohid Uddin Bhuiyan, System Analyst, Computer & GIS unit visited Jagannathpur upazila of Sunamganj district and Noakhali Sadar upazila and Mr. Mihir Kanti Sarkar, Data Entry Officer, visited Nakla and Gangachra upazila of Sherpur and Rangpur respectively to monitor the implementation progress of SPGR GIS sub-projects.

Other activities

Digital World 2014: The online crop zoning information and maps were displayed in the digital world 2014 held at BICC, Dhaka. Mr. Shohid Uddin Bhuiyan and Mr. Mihir Kanti Sarkar participated in the fair as exhibitor.

Meeting on review of research program: Md. Abeed Hossain Chowdhury, Director, Computer & GIS unit attended in the internal review of annual research and program planning workshop of ASICT division of BARI as expert scientist. He has provided valuable comments and feedbacks for the improvement of future research programs.

Meeting/seminar/workshop: The personnel of Computer and GIS unit attended various meetings/seminars/workshops under different capacity at BARC and other organizations during this period e.g. focal point meeting, PCR workshop, stakeholder workshop, monsoon and climate related workshop, Focus Group Discussion (FGD) of innovation team members, Innovation in service delivery workshop etc.

Publication: During this period, Md. Abeed Hossain Chowdhury, Director, Computer & GIS unit compiled and edited a book entitled *Hand Book of Agricultural Technology* published by BARC in 2013 under AFACI ATIN project. The handbook was distributed in upazilla, district, divisional offices of DAE, research institutes, universities, NGOs etc.

Report to MoA: During this period, prepared several ICT related reports/documents as required by the ministry of agriculture. Also a report on innovation related activities of BARC was prepared and submitted

to MoA according to the format provided under Work Improvement Team (WIT).

ICT need assessment for NATP Phase-II: Prepared the ICT need assessment document and tentative budget of BARC and NARS institutes for inclusion in the NATP Phase-II.

Digital Display Centre: The specification of equipment, budgeting and e-content guideline has been prepared and sent to PIU-BARC for facilitating the procurement process of digital display centre.

Work Improvement Team (WIT): Worked as innovation officer and member of WIT of BARC formed under Governance Innovation Unit (GIU) of Prime Minister's Office.

NUTRITION

Project Development/Project Financing

Contaminants and Adulterants in Food Chain and Their Mitigation

The project entitled "Contaminants and Adulterants in Food Chain and Their Mitigation" was implemented between May 2011 and November 2014 under the co-ordination of Nutrition Unit, BARC and the project is being funded under the NATP, Phase 1.

Objectives:

- i. Collect and collate the information derived through the component sub-projects to understand the present scenario and activities;
- ii. Development of communication materials for wide awareness building of producers, traders and consumers;
- iii. Organize disseminating training workshop/seminar and capacity building on food safety and quality
- iv. Co-ordination and monitoring of the component project activities to facilitate smooth implementation.

Reason for Undertaking the project

In the recent years, there is much concern about artificial ripening of fruits. During ripening there is a well coordinated series of changes in the fruit

composition which lead the unripe to the ripe condition. Now a day's ethane, ethephon, calcium carbide etc are commonly used in our country for faster ripening of mango, banana, papaya, pineapple and tomato at premature stages. The prohibited calcium carbide is commonly used by traders, retailers of Bangladesh at depots and wholesale markets. The use of this chemical is extremely hazardous because it contains harmful arsenic and phosphorus. The use of hazardous chemicals with higher dosages on fruits and vegetables has become a vulnerable issue in the country.

In fisheries, costal and fresh water aquaculture has evidence to contaminate from the culture environment by antibiotics, nitro furan and various toxic and odd smell producing bacteria. Application of formalin on the body surface of fish has become common practice to keep the fish stiff and fresh looking for a longer period. Use of Nogos, Sobicron and various other harmful agro-pesticides for the preservation of dried fish is also a common practice in Bangladesh. All these agents are considered as carcinogenic and equally responsible for damaging of internal organs of human body.

In Bangladesh, livestock product marketing and slaughter house management does not have any regulatory frame work that need to be developed to ensure production of good quality carcasses and safe hygienic meat. Supply of milk from widely scattered sources, non availability of cooling before and during transportation, careless handling and distribution under improper hygienic condition and willful adulteration with pond or river water and other agents are all unsanitary and health risk activities. The most commonly used and marketed popular fast food items of animal origin in Bangladesh, in most of the cases, prepared under poor hygienic environment which is considered responsible for outbreaks of various diseases after ingestion.

Grain quality of rice, the staple food of the country, is important both for internal and external market. The physicochemical and eating properties are influenced by contamination of grains. Heavy metals are an important source of food contamination and health hazard. The main threats to human health are associated with exposure to arsenic, cadmium, lead, copper and mercury. Sources of food contamination include environmental and industrial pollution, agricultural practices, food processing and packaging

which is more common in a country like ours. Absorption of heavy metals through food has been shown to have serious consequences on health, economy and productivity of the national.

In case of processed foods, harmful chemicals, non-permitted preservatives, inorganic colors are randomly being used to make the foods tasty and self stable. Non-permitted food colors and other adulterants and various chemicals and hormones at a very high dose being used in all sorts of popular processed foods, fruits and vegetables in Bangladesh.

Keep in mind the situation narrated, the Nutrition Unit of, BARC to ensure safe food for the nation by generating research based information for the policy makers, producers, traders, processors and consumers, has undertaken the present study covering five principal areas of food and food processing like rice grain, poultry and meat products, fish and fishery products, processed foods products and fruits and vegetables etc. The result so far achieved by the different component of the project are briefly given below:

BARC Coordination and Monitoring Unit

To achieve the set out objectives of the coordination and monitoring unit the sub project unit of BARC schedule wise performed the principal responsibility to supervise and monitor of the component research projects and their activities and provided appropriate feedback and technical assistance. In addition, review of research findings, area based consultation meetings, monitoring of field adulteration practice of different food products, status analysis and awareness building of stakeholders through training and motivation also performed as regular function of the coordination unit. During the project period, the unit regularly monitored the ongoing research progress of BARI, BFRI, BLRI, BRRI, BARI and Chapainawabgonj mango production and trade areas and totally performed 16 visit to 5 component institutes and Chapainawabgonj mango growing areas. The unit organized five research progress review workshops and one expert consultation meeting centrally at BARC, Dhaka. In addition, one special workshop on use of chemicals in fruit production with special emphasize to mango ripening was also organized at Volarhat Upazila Auditorium on 22.06.13. During this period the central unit also organized four training programs for awareness creation and knowledge improvement of stakeholders

on safe and hygienic production of dry fish, milk and meat at different locations of the country (Cox's Bazar, Chittagong and Sirajgonj etc). The coordination unit published two extension leaflets on mitigation of contamination of adulterated milk, meat and formalin adulteration in fish and one popular book describing status of adulteration practices, sources, level of acceptance, precautions needed and mitigation measures/protocols etc. Following the recommendation of the research progress review workshop of 2011-12, the unit also conducted a survey in the selected markets of Dhaka city to identify adulteration practices and its status in different food items like vegetable, fruits, egg, milk, meat, fish and fish products and various processed foods and produced report. Financial progress, reporting and procurement activities of the unit performed as per plan of the project.

BARI Component

Surveys were conducted to find out the present status of the usage of synthetic pesticides and ripening chemicals in selected fruits like mango, banana, pineapple, papaya and vegetables like tomato, brinjal, country bean and bitter gourd. Major fruit growing areas/districts namely Tangail, Bogra, Rajshahi and Chapai Nowabgonj were selected for fruits and seven districts such as Gazipur, Bogra, Rajshahi, Jessore, Narsingdi, Comilla and Jamalpur were selected for survey on vegetables. All fruit and vegetables growers except pineapple used synthetic pesticides such as cypermethrin, chlorpyrifos, emamectin benzoate, spinosad, imidachlorpid, thiamethoxam, chlorantraniliprole, etc for protecting their crops from insect pests and diseases. Most of the banana and pineapple growers applied PGR like planofix, superfix, ripen-15, tomtom and promote during fruit development for enlarging the fruit size. The pineapple growers on the other hand further applied PGR in fruit before 3-4 days of harvest for uniform and attractive color development. None of the mango growers applied any ripening chemicals in mango; however, 10-15% of small and medium traders applied ethephon in premature fruit after harvest for external color development. In contrast, none of the papaya growers applied ripening chemicals at pre- or postharvest stages. Most of the tomato growers in the study areas particularly at Rajshahi and Jessore districts applied ripening agents @2500 ppm-8000 ppm in immature green tomato fruit for developing uniform red color to get lucrative price in the early market. Among 120 collected vegetables samples, 20 samples contained

detectable level of residue of chlorpyrifos, acephate, quinalphos, chlorantraniliprole out of which most were found below Maximum Residue Limit (MRL). The estimated residue level of ethephon in 30 collected fruit samples was found below the MRL of 2 ppm. About 30% of the pesticide samples collected from different markets contained 50% active ingredients from their mentioning levels on the bottles. On the other hand, 30% of collected ethephon samples contained 80% active ingredients.

Results of the laboratory experiments revealed that ethephon can be applied @750-1000 ppm at breaker-turning stage of tomato for uniform ripening within 6 days at ambient temperature (22 ± 2 °C). The residual level of the applied ethephon was estimated remains 0.09 ppm at edible stage, which was much lower than that of MRL of 2 ppm. Similarly, for uniform ripening of banana cv. 'Meher Sagor', ethephon can be applied @750-1000 ppm at matured green stage for proper ripening within 5 days at ambient temperature (22 ± 2 °C). At marketable stage of banana, the residual level both in peel and pulp was estimated 0.095 ppm. On the other hand, for artificial ripening of mature green mango cv. 'Langra' and local grown papaya fruit at color stage two (mature green with trace yellow), postharvest application of ethephon @ 500-750 ppm showed best result at ambient conditions (23 ± 2 °C and $80 \pm 5\%$ RH). The residue levels of ethephon were estimated as low as 0.30 -0.72 ppm and 0.32-0.45 ppm for mango and papaya, respectively. Both of them were lower than the MRL of 2 ppm. Further, a total of 8 mango samples were tested for detecting formalin content and found that all of the samples contained formalin below the detection limit. Moreover, 20 samples of mango and papaya were tested for heavy metals such as As, Fe, Co, Cd, Hg, Ni content and found below the contamination level.

BFRI Component

The common contaminant or adulterant in fish and fish products are mud or sand which results from unhygienic handling or transportation. Besides, unauthorized pesticides and dyes are illegally used in fish marketing. Unhygienic or formalin treated ice (17.86%), pesticides (10.71%), color (7.14%) and drug (7.14%) are used as adulterants in fish and fish products. Carps (50%), small indigenous fishes (31.57%) and shrimps (18.42%) are contaminated by formalin. On the other hand, pesticides (76.0%) are the major adulterants in dried fish.

Megazeo, Zeofresh, Zeotox, Gastrap, Gas tablet and Zeolite are found to be the most widely used chemical compounds by 45% farmers for soil and water quality management. On the contrary, Timsen is the most widely used chemicals by 42% farmers as disinfectants. The study also pointed out problems associated with the use of chemicals. Biochemical analyses showed that most of the commercial fish feeds and commonly used feed ingredients are of poor quality. The nutritional studies revealed that about 68% of the marketed feed ingredient samples are of poor quality (adulterated) from both animal and plant origin. On the other hand, the nutritional quality of commercial nursery (18%, 31% and 51%), starter (24%, 34% and 42%), grower (29%, 36% and 35%) and finisher feeds (31%, 40% and 29%) were highly satisfactory, satisfactory and not satisfactory, respectively.

Bacteriological investigation of widely cultured climbing perch, koi fish (*Anabas testudineus*) from farmers' pond revealed significantly higher bacterial count (8.44 ± 0.04 log CFU/ml) when compared to well managed BFRI pond samples (7.92 ± 0.17 log CFU/ml) ($p \leq 0.05$). Bacteria isolated as *Pseudomonas* spp. (21.40%), *Aeromonas* spp. (33.46%), *Vibrio* spp. (14.78%), *Salmonella* spp. (21.40%) and *E. coli* (8.94%), indicated contamination by those health hazardous microorganisms.

Six species of marine dried fishes namely, silver pomfret (Rup chanda), Bombay duck (Loittya), ribbon fish (Chhuri), sardines (Chapila), minnows (Mola) and anchovy (Olua) were sampled from Cox's Bazar, Kuakata and Dubla Island. Arsenic (As), Iron (Fe) and Zinc (Zn) concentration was found higher than the permissible level in three species of dried fish (rup chanda, loittya & chhuri) sampled from three locations. However, three other heavy metals cadmium (Cd), copper (Cu) and lead (Pb) were found within the recommended level.

In order to determine the intensity of industrial heavy metal pollution in the River Karnaphuli of Chittagong study was conducted to assess heavy metal contamination in water, sediment and fish samples. Dissolved oxygen concentration was found very low in winter. Cu, Cr and Ni concentrations were below detectable limit and Fe, Pb and Al were found in higher concentration in winter compared to summer. Also Cu, Fe and Pb were found in higher concentration in soil sediment samples. On the other hand, Cu, Cr, Pb and Ni were identified in low amount in fish and shrimp but

high in snail. But the bioaccumulation of Al and Fe were in high concentration in almost all samples. Water quality of Karnaphuli River is deteriorating and the organisms are getting polluted due to discharge of untreated industrial wastes. Another study was conducted on heavy metal contamination in water, sediment and fishes from the Passur River in the Mongla port area of Khulna. The concentrations of Cu, Zn, Fe and Cr from water were much lower than the permissible level. The concentrations of Cr, Cu, Ni, Pb, and Fe in the sediment samples were higher than the permissible limit. While conc. Of Fe ranged from 23481.61 to 15339.4 mg/kg. Heavy metals like Cd and Zn concentrations were within acceptable limits.

Although use of formalin in fish markets got reduced due to various awareness measures taken by the Govt. and use of formalin in fish did not showed any preference to fish species or size. Formaldehyde conc. obtained in fishes from three different wet markets of Mymensingh Sadar ranged from 1.4 to 7.35 $\mu\text{g/g}$ in Indian major carp, rohu (*Labeo rohita*), tilapia (*Oreochromis nilotica*) and SIS, kachki (*Corica soborna*). On the other hand, formaldehyde conc. in freshly caught rohu, tilapia and Thai koi (*Anabus testidineus*), from ponds showed natural formaldehyde in their muscle having values of 1.45, 1.85 and 2.60 $\mu\text{g/g}$ respectively. The marine fish viz. loyitta (*Harpodon nehereus*), chhuri (*Lepturacanthus savala*) collected from the landing center of BFDC at Cox's Bazar and investigated in frozen condition showed to have contained naturally occurred formaldehyde as 3.9 and 1.55 $\mu\text{g/g}$, respectively. Spectrophotometrically determination of formaldehyde conc. showed highest value of 7.35 $\mu\text{g/g}$ in market sample of kachki, and naturally occurring formaldehyde conc. showed higher conc. of 2.6 $\mu\text{g/g}$ in Thai koi from freshwater and 3.9 $\mu\text{g/g}$ in loyitta fish from marine source. Hence study suggested that fish from wet market contained a certain amount of formaldehyde and fishes from both freshwater and marine sources showed contain natural occurring formaldehyde in their muscle at different conc. Experimental trial for retention of formalin on fish immersed in water showed that after immersing in water for 1-2 hours the level of formalin in fish was reduced.

BLRI Component

To determine the contaminants and adulterants in milk, meats and feed available in the market under selected locations were collected and analyzed in the Lab. The fat % among the Brand milk samples varies from 3.53

to 3.61 which are standard level except the Super Dairy (3.28) and Tatka (3.40). Lactose and SNF % were found as per recommended level. Milk samples collected from different areas of Bangladesh sold by vendors contained low fat (2.94 to 3.44 %) and protein (2.93 to 3.22%) percentage as per recommended level except protein (3.64%) in Chittagong local market. The total viable count (cfu/ml sample) was higher (7.6×10^6 to 2.35×10^{12}) in local markets (vendor) of different locations and the lowest in all Brand milk (3×10^1 to 3.5×10^5) compared to the recommended level except Super Dairy Nasirabad (1.5×10^{12}). The Coliform count in all collected liquid milk samples was higher (0.7×10^2 to 5.2×10^{11}) compared to the recommended level (<50) except Aarong liquid milk, RD UHT milk, Tatka, Pran pasteurized liquid milk, Farm Fresh UHT milk and milk collected from Savar area. In respect to the presence of heavy metal both in Brand and Local milk samples, Cr content was higher (0.53 to 0.96 ppm) in all milk samples compared to the IAEA Values (0.27 ppm : range 0.22-0.29 ppm) and Pb & Cd were found in trace amount. Milk sold by vendors revealed that 6.67 to 64%, 6.67 to 25% and 40 to 74% milk samples in Savar, Dhaka, Joypurhat, Rangpur, Chittagong, Gazipur, Pabna and Sirajgonj locations were found adulterated/contaminated with formalin, cane-sugar and pond/river water, respectively except starch and 25% of commercial milk was showed presence of sugar. On the other hand, 10, 18.75 & 10 % milk samples in Savar, Dhaka and Sirajgonj locations were found adulterated/contaminated with hydrogen peroxide. Bacteriological study in raw meat (beef) samples revealed that the total viable count (cfu/gm meat) was higher at two different times (2.3×10^5 to 1×10^{10}) in Savar, Dhaka, Sirajgonj, Pabna and Joypurhat. Coliform count in collected raw meat samples from Savar, Dhaka, Sirajgonj, Pabna and Joypurhat was higher (1.5×10^3 to 1.5×10^7) compared to the recommended level at 12:00 pm and Savar & Dhaka meat samples was almost standard to recommended level. Meat collected from super market (code-1 & code-5) was below recommended level of the total viable count (cfu/gm meat) and the Coliform count at two different times but samples of code-2, code-3 and code-4 revealed that the total viable count and Coliform count were higher (1.3×10^5 to 6×10^9 and 1×10^5 to 4×10^6) at two different times. Broiler meat collected from both farm and market under Joypurhat location revealed that the presence antibiotic residues such as Ciprofloxacin (96.40 & 168.80 $\mu\text{g/kg}$) and Sulfonamide (86.50 & 217.50 $\mu\text{g/kg}$) were higher compared to maximum (30 $\mu\text{g/kg}$ and 100 $\mu\text{g/kg}$) recommended level

(MRL). Ciprofloxacin residues in eggs in all locations were found higher compared to the recommended MRL and more than 80% egg samples were shown higher Sulfonamide, Oxytetracycline and Enrofloxacin, content than MRL in all locations. A total of 32 commercial feed samples were collected, out of which 11 were cattle feeds and remaining 21 were poultry feeds. Preliminary observation revealed that 54.54% of compound cattle feeds were contaminated with leather meal. On the other hand, out of 21 commercial poultry feeds, 47.62% were shown positive of leather meal. Arsenic (As) content of two commercial feeds was higher compared to MRL in poultry feed. This higher presence of As in poultry feed may be due to contaminate with feed additives. Similarly, in cattle feed, As content was significantly higher in six sample and compared to MRL in case of cattle feed. Analysis of Pesticide such as DDT, Aldrin, Heptachlor, Endrin & Dieldrin residue level in rice straw (Amon and Boro), maize strover and wheat straw revealed that all kind of samples were showed negative in result.

BRRRI Component

A sum of 203 rice and rice based food product (Popped rice, puffed rice and flattened rice) samples were collected for heavy metal estimation from three types of locations like- i. Farmer's fields (industrial and non-industrial), ii. Market retailers and iii. Overseas origin (imported) from Gov't silos. Out of eighty six samples of industrial fields eight samples were found to be highly contaminated having values greater than the risk level of daily intake of Cd ($>0.07 \text{ mg/416.01 gm}$). Cadmium content in the non industrial rice samples ranged from 0.000mg/416.01 gm to 0.125mg/416.01 gm. Among seventy six samples collected from four market locations, twenty one samples were found having greater amount than the risk level of daily intake of Cd. No samples collected from Govt. silos were found to have greater than the risk level of daily intake of Cd. All the 203 samples estimated for Chromium content had Chromium level lower than the risk level of daily intake ($>0.35 \text{ mg/416.01 gm}$). Only one sample from industrial field in Narayanganj district had shown to have a very high amount of Lead in it. No other sample from any of three sources had a higher amount of lead than the risk level of daily intake of Pb ($>0.25 \text{ mg/416.01 gm}$).

One hundred and sixty four rice samples were investigated for fungi association, which were collected from different CSD and LSD food storages of south-western Khulna and Satkhira districts. Fungi were

identified as *Aspergillus*, *Penicillium*, *Fusarium*, *Rhizopus*, *Curvularia*, *Tricochonis* and *Alternaria* sp. Generally infection was low. Average incidence of *Aspergillus* (1.87%) was higher followed by *Penicillium* (1.60%), *Rhizopus* (1.26%) and *Fusarium* (0.79%) irrespective of the storage. Fungal infection ranged 0.57-2.43% in CSDs and 0.66-2.53% in LSDs. Infection level did not increase with storage period irrespective of storage or origin.

All four stored grain fungi were more prevalent in Bangladesh rice than Thailand, India and Pakistan rice in Maheshwarpasha CSD. Similar results were also found in Khulna CSD both for *Penicillium* and *Rhizopus*. But *Aspergillus* and *Fusarium* were found more in Indian rice. However rice imported from any of the country like Thailand, India and Pakistan was less infected and not harmful.

Among 41 out of estimated 46 rice samples, none of them contained aflatoxin B1 above the UNICEF/WHO/FAO maximum permissible level 30 µg/kg (ppb) in foods for human consumption. Only 5 samples contained aflatoxin B1 ranged from 5.39-8.08 and 3 samples contained 0.06-0.13 µg/kg aflatoxin B2. Incidence of carbofuran 10G was detected in the harvested rough rice among the tested 6 insecticides.

BAU Component

The project deals with the assessment of contaminants and adulterants in processed food products. A baseline survey was conducted among 1054 respondents who opined that processed food products available in markets are highly adulterated. The preventive measures indicated by respondents that need to be undertaken to control adulteration in processed food products were *Adopting BSTI standard* (22.34%-highest), *Enforcing law and imposing punishment* (21.98%) and “*Social motivation of consumers*” (20.35%). The commercial brands collected for analysis were four fruit juices, three tomato ketchup, five jams (pineapple & mango), two jelly (Pineapple and Mango), five pickles (Jujub, Tamarind, & Mango), and one orange squash samples, five types of brand turmeric and Chili powder and Local Non-brand product, five Coriander powder, two Cumin powder and three mixed powder, five Mustard oil and four coconut oil sample, five Chanachur and four noodles samples. The parameters such as fruit juices, pulps, total soluble solids, artificial sweeteners, harmful food

Pictorial view of some monitoring activities of the SPGR project



colors, acidity, preservatives (sodium benzoate, potassium-meta-bisulphite), heavy metals content (arsenic, lead, copper, zinc and tin), and microbial load, yeast and mold counts of different products were carried out in the laboratories of Departments of Food Technology and Rural Industries, Biochemistry and Microbiology and Hygiene, BAU, Mymensingh, BSTI, Tejgoan, BCSIR, Lab., Dhaka and SGS Bangladesh. The jams, jellies and squash samples tested were found to contain artificial sweeteners and less quantity of pulps/juices than that of reference value (RV) of BSTI standards. In pickles samples fluid portion was higher and acidity lower than that of RV. In samples of juices, natural fruit juice content was lower and total plate, yeast and mold counts were higher than that of RV. Total soluble solids, acidity and coliform count of tomato ketchup were higher than that of reference value of BSTI standards. In spices powders, moisture, total ash, non-volatile ether extracts and total bacterial count were found higher than that of RV. The tested oils were found to contain very high moisture, insoluble impurities, acid value, low saponification and iodine value, and low erucic acid (Mustard oil) indicating adulteration and low shelf-life. The moisture, total ash and acid value of all the Chanachur samples were found higher than that of RV indicating adulteration and susceptibility to rancidity. Forty beneficiaries were trained in two batches for detection of adulterants in processed foods and food safety management in food industries. A manual on *Methods for detection of adulterants in foods* published for use by the food processing industries. Nine students conducted post-graduate research with the financial assistance from this project and awarded MS (Food Engineering) degree.

Printing of extension materials

During the reporting period, based on the research findings, Nutrition unit published some extension materials on “Food adulteration and it’s mitigation measures.” All of these publications are highly appreciated by the different stakeholders like researcher, academician, traders, extension workers as well as policy makers.

Project Implementation

Dr. Md. Monirul Islam, Director (Nutrition) worked as the co-coordinator of the co-ordinated SPGR sub-project entitled “Contamination and adulterants in Food Chain and Their Mitigation”.

Policy Level Contribution

Expert Committee

a. The Nutrition Unit contributed much in several programs on nutritional advocacy, motivation of rural households and project design by the NARS Institutes, Bangladesh National Nutrition Council (BNNC), Bangladesh Food Safety Authority (BFSA), Institute of Food Science and Technology (IFST) of BCSIR, ICDDR’B and few NGOs working at the grassroots level.

National Level Collaboration and Linkages

- a. Nutrition Unit continued to be closely involved in the process of programme development, review mechanism of various food and nutrition related activities of NARS, relevant institutes and universities. Besides, the unit is also involved in planning and organization of activities undertaken by the institutions, like, DAE, BNNC, IFST, ICDDR’B WFP, INFS, FAO etc., working in the field of food and nutrition, food safety, primary health care, food habit and cooking practices.
- b. Dr. Md. Monirul Islam Director (Nutrition) involved as the member of the Divisional Committee on i). Irradiated Food Products Division of Bangladesh Standards and Testing Institution (BSTI); ii). Fish and Fisheries Products (AFDC-23); and iii). Expert Member of the Bangladesh Food Safety Authority (BFSA). He actively contributed to the BSTI to provide quality products and developing standards of these different products and to play the key role by providing suggestion/expert opinion to the BSFA to minimize Food adulteration and its mitigation measures.
- c. Dr. Md. Monirul Islam Director (Nutrition) contributed to produce the Dietary Guidelines of Bangladesh, published by FAO and BIRDEM.

Research Management and Coordination

As a part of the yearly activities, Nutrition Unit was involved in the review, monitoring and participatory program development of the nutritional activities of the DAE, DAM, BIRTAN, BNNC, IFST and ICDDR,B. As Director (Nutrition) took part in BARC’s centrally monitoring of the supplementary research funding program implemented by the different NARS Institutes and Universities during the reporting year.

II. HUMAN RESOURCES DEVELOPMENT

Crops

Training on Knowledge and Awareness Building on Agricultural Policies of Bangladesh

A 3-day long training programme on *Knowledge and Awareness Building on Agricultural Policies of Bangladesh* was organized by Crops Division, BARC during 23-25 June 2014 at BARC campus, Dhaka. Forty participants from DAE, BADC, SCA, BARI, BRRI, BINA, BSRI, BJRI, CDB, SRDI, BSRTI, BARD, MoA and BARC were attended the training programme. A total of 12 important topics were selected in the training programme as: 1) Agricultural Research in Bangladesh: Priority, Challenge and Opportunity; 2) Sixth five years Plan: Strategies for raising productivity and Agricultural growth; 3) National Agricultural Policy, 2013; 4) New Agricultural Extension Policy, 1996; 5) National Seed Policy, 1993; 6) Fertilizer (Management) Act, 2006; 7) Principles of Good Agricultural Practices (GAP) in fruits and vegetable; 8) National bio-safety guidelines and rules; 9) Food Safety Act; 10) Plant Quarantine Law; 11) National Crops and Forest Biotechnology Policy Guidelines and 12) Bangladesh Climate Change Strategies and Action Plan.

In the concluding session, the participants expressed their views on the training programme and opined this is very well organized good quality training in the field of agricultural research and development. The selection of the topics and speaker were very much resourceful and they thanked the BARC authority to continue this type of training in larger scale. Executive Chairman, BARC distributed certificates among the trainees. Dr. Mian Sayeed Hassan, Principal Scientific Officer (Crops) coordinated the training programme.

Training on Seed Quality Management

A three day long training programme was conducted during 6-8 May 2014 at BARC, Dhaka. It was the 5th year of this training organized by crops Division, BARC. A total of 12 important topics were selected in the training programme as: 1) Importance of quality seed for higher production; 2) Agronomic considerations in seed production for major cereals; 3)

Breeder seed production and multiplication techniques of major crops; 4) Insect management of quality seed production and storage; 5) Seed quality test and invigoration through seed priming; 6) Hybrid seed production & multiplication in self and cross pollinated crops; 7) Modern techniques of postharvest management for quality seed production; 8) Seed production and multiplication techniques of major vegetables; 9) Seed health and disease management of major crops; 10) Seed production and business in private sector; 11) Seed certification system in Bangladesh and 12) Seed Policy: Ordinance, Rules & Laws. Forty participants from DAE, BADC, BARI, BRRI, SCA, BINA, BSRI, BJRI, CDB, Lal Teer Seed Ltd., ACI Seed Ltd., BRAC Babilon Agri-Science Ltd, Metal Afro Ltd, Giant Agro Processing Company Ltd, Getco Seed Ltd. Ispahani, Supreme Seed Ltd, Krishibid seed, Partex Seed Ltd and BARC were attended the training programme.

Participants of the training in concluding session thanked BARC to continue this training up to 5 years. The selection of the topics and speaker were very much resourceful and they thanked the BARC authority for arranging this important training. Dr. Md. Kamal Uddin, Executive Chairman, BARC distributed the certificates among the trainees. Dr. Mian Sayeed Hassan, Principal Scientific Officer (Crops) coordinated the training programme.

Training on Good Agricultural Practices (GAP) in Fruits and Vegetables Production

A day long training programme was conducted on 23 March 2014 at Regional Horticultural Research Station, Chapainawabganj under AFACI-GAP Project, BARC. A total of 5 important topics were delivered by the speaker of BARI, Chapainawabganj and BARC. The lecture topics were: 1) Good Agricultural Practices (GAP) for mango production; 2) Modern techniques of Mango production; 3) Disease and insect management for mango production; 4) Insect management for mango production and 5) Farmers responsibilities for quality mango production. Total twenty four participants out of which 16 mango farmers & traders, 6 DAE Sub assistant Agricultural Officers (SAAO) and 4 Scientific Assistant of BARI were participated in the

training programme. This was the first time Good Agricultural Practices (GAP) training on mango production conducted in Chapainawabganj.

Training on Phytosanitary Measures and Food Safety Issues in Bangladesh

A training entitled *Phytosanitary Measures and Food Safety Issues in Bangladesh* was organized during 02-03 April 2014 through PIU-NATP funding of BARC.



Technical session



Certificate distribution

Review Workshop on Crop Improvement Programme of NARS institutes

A two day long review workshop on *Crop Improvement Programme of NARS institutes: Research progress 2012-13 and Research Programme 2013-14* was organized by Crops Division, Bangladesh

Agricultural Research Council on 21-22 October 2013 involving 64 participants from BARI, BRRI, BJRI, BSRI and BINA. The objective of the workshop was to review the status of conventional and biotechnological research activities and to enhance collaboration among the NARS institutes. Dr. M. Khalequzzaman Akanda Chowdhury, Member-Director (Crops), BARC chaired the inaugural session and Dr. Wais Kabir, Executive Chairman, BARC was present as Chief Guest. In the inaugural session Dr. Abul Kalam Azad, Chief Scientific Officer (Crops), BARC welcomed the participants and described the objective of the workshop.

Dr. Wais Kabir highlighted on creation of variability and introduction of desirable genes from both within and inter species through biotechnological approaches. Dr. M. Khalequzzaman Akanda Chowdhury pointed out that the countries like China, India, Iran, the Philippines and other Asia Pacific countries have already harnessed the benefits of biotechnological research for food security in addition to conventional breeding. So, we have yet to exploit the potential benefits of biotechnology and also stress physiology for sustainable agricultural production, productivity and food security.

Four technical sessions (Varietal Improvement of Cereals, Oilseeds and Pulses; Varietal Improvement of Horticultural Crops, Cash Crops & Biotechnology and Crop Improvement through Physiological research) were included. A total of 24 presentations on different crops were delivered by the respective scientists of five NARS institutes. The technical session was followed by plenary session chaired by Dr. M. Khalequzzaman Akanda Chowdhury, Member Director (Crops). He reiterated the need of research investment in crop improvement programme. Eight expert members were present from BSMRAU, BAU, SAU and DU. A number of recommendations were made based on the comments of the expert members with emphasis on the development of stress tolerant variety to salinity, drought, heat etc. of different crops and these were sent to concerned institutes for including into their research programme.

Review Workshop on Crop Protection of NARS institutes

A Review Workshop on Crop Protection was held on 26-27 August 2013. Crop protection is divided into two parts, entomology and plant pathology. In first day 60 entomologists and in 2nd day 60 plant pathologists from

five NARS institutes viz. BARI, BRRI, BJRI, BINA and BSRI took part in the two days workshop. The Research progress for 2012-13 and Research programs for 2013-14 were thoroughly discussed in the workshop. The workshop proceedings were sent to all participating institutes and every participant.

Planning and Evaluation

Review Workshop on Monitoring and Evaluation Activities in the NARS

A day long workshop on *Monitoring and Evaluation Activities in the NARS* was held at the BARC Conference Room on 10 February 2014. The objectives of the workshop were to review the M&E activities of the NARS institutes, particularly SPGR sub-projects of NATP and institutional research programmes and identify the constraints in operationalization of the activities. Besides these, the view of the workshop was to formulate suggestions in strengthening the M&E activities at the NARS and in particular at BARC. In total 90 participants comprising the M&E Cell members of BARC and the NARS institutes, scientists of BARC, consultants of the Project Coordination Unit (PCU) and the Project Implementation Unit (PIU) of BARC attended the workshop. Dr. Paresh Chandra Golder, Member-Director (Planning & Evaluation) presided over the inaugural session. Dr. Md. Kamal Uddin, Executive Chairman, BARC was present as the Chief Guest. Dr. Md. Kabir Ikramul Haque, Director, PIU-BARC delivered the welcome address. Dr. Kabir in his address briefed on the workshop objectives and importance of monitoring and evaluation in research activities. Mr. M. Anwar Iqbal, M & E Expert, PIU-BARC made a brief presentation in the area of

monitoring and evaluation and impact assessment. He stressed on the strengthening of the M & E cells of NARS as in most cases there is no designated Planning Division/ cells there. Dr. Kamal Uddin, the Chief Guest and Executive Chairman, BARC stressed on the M&E aspects of SPGR and as well as institutional research activities, the value and need of M&E as a requirement of investment in research. He told that without proper monitoring effort and accountability, objectives of the projects cannot be attained. He added that future research fund may hamper for lack of transparency, which can only be ensured through timely monitoring and evaluation. The chair person Dr. Paresh Chandra Golder opined that the M&E activities need to be performed with due importance and urgency to achieve the set-objectives. He also requested the M&E Cell members of the ARIs to monitor the SPGR sub-projects as well as the institutional core research activities regularly for smooth running of the project activities. All the M&E cell convenors/their representatives presented SPGR as well as the institutional core research monitoring activities covering the of both technical and financial aspects. Followed by the inaugural, the two technical sessions were chaired by Dr. Md. Kamal Uddin , Executive Chairman, BARC and Dr. Paresh Chandra Golder, Member Director (P&E) with rapporteurs namely Dr Md Abdul Awal, PSO (P&E) and Dr. Nazmun Nahar Karim, PSO (Engineering). The participants took part in the discussion and interacted in the workshop and suggested some appropriate actions which were adopted as the workshop recommendations to be followed by all concerned.

Comments/Suggestions made in the workshop on the activities of different M&E Cells of the NARS institutes:

SI. No.	Name of the Institute	Observations/Comments/Suggestions	Decision/Action to be taken
1.	Bangladesh Agricultural Research Institute (BARI)	<ul style="list-style-type: none"> • M&E members faced transport problem for visiting field experiments • The M&E Cell needs to be reorganized due to change in management. • The members of the committee are reluctant in monitoring without incentive. 	<ul style="list-style-type: none"> • M&E Cell members may be provided transport and DSA from the sub-projects visited. • BARI to organize a joint meeting of the M&E cell along with the PI's of BARI soon with DG, BARI in the chair, where MD (P&E), Director-PIU & M&E Expert of PIU-BARC may be invited.

Sl. No.	Name of the Institute	Observations/Comments/Suggestions	Decision/Action to be taken
2.	Bangladesh Rice Research Institute (BRRI)	<ul style="list-style-type: none"> • BRRI did not follow the unified presentation format and not mentioned number of core research projects, implementing programs and general observation of the monitoring members. • Fund release and budget reallocation was lengthy and not smooth. • Necessary reports as per LOA obligation are not being submitted regularly. 	<ul style="list-style-type: none"> • In future BRRI should follow the prescribed presentation format. • Fund release & budget reallocation to be done in time. • As per LOA all necessary reports should be provided timely.
3.	Bangladesh Jute Research Institute (BJRI)	<ul style="list-style-type: none"> • BJRI presented M & E cell in future BJRI should follow the prescribed presentation format activities and but not followed the unified presentation format and not mentioned about core research program. • Individual procurement and financial power should be delegated to the PI/PI's by the institution and program/project fund should be released in time. • Seed, fertilizers were not supplied to farmer's plot timely. • Reports were not provided timely as per LOA. 	<ul style="list-style-type: none"> • As per LOA all necessary reports should be provided timely. • Comments and Suggestions should be specifically made on technical and financial progress report. • Provide requisite transport facilities to conduct research in the farmer's plot and monitoring purpose • BJRI to organize a joint meeting of the M&E cell along with the PI's at BJRI soon. DG, BJRI to chair the meeting where MD(P&E), Director -PIU & M&E Expert of PIU-BARC may be invited.
4.	Bangladesh Sugarcane Research Institute (BSRI)	<ul style="list-style-type: none"> • Both SPGR & core research programmes of BSRI were covered in presentation by the Director (Research). • Institutional research programmes of BSRI were reported to be satisfactory. • One of the SPGR sub-project activities of BSRI was not found satisfactory. 	<ul style="list-style-type: none"> • The participants appreciated reporting of the satisfactory progress of institutional research programmes. • BSRI to organize a joint meeting of the M&E cell along with the PI's at BSRI soon. DG, BSRI to chair the meeting where MD(P&E), Director - PIU & M&E Expert of PIU-BARC may be invited.
5.	Bangladesh Institute of Nuclear Agriculture (BINA)	<ul style="list-style-type: none"> • The M & E cell of BINA has not performed any monitoring activity till date. 	<ul style="list-style-type: none"> • DG, BINA is requested to please review and look into the M&E Cell activities of BINA. • BINA to organize a joint meeting of the M&E cell along with the PI's at BINA soon. DG, BINA to chair the meeting where MD(P&E), Director -

Sl. No.	Name of the Institute	Observations/Comments/Suggestions	Decision/Action to be taken
			PIU & M&E Expert of PIU-BARC may be invited.
6.	Bangladesh Livestock Research Institute (BLRI)	• BLRI presented M & E cell activities according to the prescribed presentation format and report was satisfactory	BLRI to organize a joint meeting of the M&E cell along with the PI's at BLRI soon. DG, BLRI to chair the meeting where MD(P&E), Director -PIU & M&E Expert of PIU-BARC may be invited.
7.	Bangladesh Fisheries Research Institute (BFRI)	• BFRI was absent	• Initiative should be taken to attend the next seminar
8.	Bangladesh Forest Research Institute (BFRI)	M&E activities of BFRI are not functioning properly	• M&E Cell activities needs to be strengthened.
9.	Soil Resource Development Institute (SRDI)	• M&E activities of SRDI are not functioning properly.	• M&E Cell activities may be strengthened and suggested to organize a joint meeting of the M&E cell along with the PI's.
10.	Bangladesh Tea Research Institute (BTRI)	• The members of M&E cell of BTRI were absent	• Initiative should be taken to attend the next seminar

Workshop on Progress Review of Research Project under Research Grant Fund of BARC

A two-day long *Workshop on progress review of research project under Research Grant fund of BARC* was held at the BARC Conference Room # 1 on 22-23 June 2014. The objectives of the workshop were to review progress review of project activities of the NARS institutes and agricultural universities to identify the constraints in implementation of the activities. Besides these, the view of the workshop was to formulate suggestions in strengthening the activities at the NARS and in particular at BARC. In total 90 participants comprising the scientists of BARC and principal investigators of the NARS institutes, universities attended the workshop. Dr. Paresh Chandra Golder, Member-Director (Planning & Evaluation) presided over the inaugural session. Dr. Md. Khaled Sultan, Director (Research), BARI Gazipur was present as the special Guest. Dr. Md. Abdul Awal, PSO (P&E), BARC delivered the welcome address. Dr. Md. Kamal Uddin, Executive Chairman, BARC was the Chief Guest of the workshop. The Executive Chairman stressed on the workshop aspects and as well as institutional research activities, the value and need of

research workshop as a requirement of investment in research. He told that without proper monitoring effort and accountability, objectives of the projects cannot be attained. He added that future research fund may hamper for lack of transparency, which can only be ensured through timely monitoring and evaluation. The chair person Dr. Paresh Chandra Golder opined that the research activities need to be performed with due importance and urgency to achieve the set-objectives. He also requested the principal investigators of the NARS institutes to monitor the research activities regularly for smooth running of the project activities. Followed by the inaugural session, two technical sessions were chaired by Dr. Md. Kamal Uddin, Executive Chairman, BARC and Dr. Paresh Chandra Golder, Member Director (P&E) with rapporteurs namely Dr. Md. Abdul Awal, PSO (P&E), Dr. Md. Baktear Hossain, PSO (Soils), BARC, Md. Mosharraf Uddin Molla, PSO (AERS), BARC and Dr. Md. Khorshed Alam, PSO (Crops), BARC. The participants took part in the discussion and interacted in the workshop and suggested some appropriate actions which were adopted as the workshop recommendations to be followed by all concerned.

Training Workshop on Project Development and Management

A five day-long *Training Workshop on Project Development and Management* was organized by the Planning and Evaluation Division, Bangladesh Agricultural Research Council, during 22-26 April 2014. Dr. Md. Kamal Uddin, Executive Chairman, BARC was present in the inaugural session as chief guest. Dr. Paresh Chandra Golder, Member-Director (Planning & Evaluation) presided over the inaugural ceremony. Senior Officers from different divisions of Bangladesh Agricultural Research Council were also present in the inauguration ceremony. Dr. Abdul Awal, Principal Scientific Officer (P&E), BARC and the course coordinator of the workshop delivered welcome address. Twenty five participants from different NARS institutes including BARC attended the workshop.



Dr. Paresh Chandra Golder, Member-Director (Planning & Evaluation), BARC addressing in the training workshop of Project Development and Management held on 22-26 April, 2014

Resource persons were drawn from BARC, National Academy for Planning and Development, and Bangladesh Agricultural University. The course content of the training workshop included the topics on project cycle, project appraisal, logical framework, preparation of different types of project documents (DPP/RDPP/TPP/RTPP), critical path method, result based monitoring, PPR-2008, financial delegations etc. The workshop was conducted based on class lectures, practical sessions and open discussions. The chief guest in his speech mentioned that this training workshop was organized to make the participants conversant with project planning and management. The chairperson of

the training workshop in his speech hoped that this training would be helpful for the participants to prepare and manage different kinds of projects properly and efficiently. The workshop ended on 26 April, 2014 through a certificate giving ceremony where the Executive Chairman, BARC was present as chief guest.

Forestry, NRM

National Seminar on Fruit Tree Plantation Programme 2014

Organized a national seminar on fruit tree plantation programme on 16 June, 2014 at A.K.M. Giasuddin Milky Auditorium, Farmgate, Dhaka. Honorable Minister Mr. Sayed Ashrafur Islam, MP, Ministry of Cooperative and rural Development was present as Chief Guest and the Seminar was presided by Dr. S.M. Nazmul Islam, Secretary, Ministry of Agriculture. Dr. M. Mofazzal Hossain, Prof. Dept. of Horticulture, BSMRAU, Gazipur was the keynote speaker. The programme was undertaken as a part of national plantation programme.

Workshop on Agroforestry in Hill Ecosystem of Bangladesh

A two days workshop on *Agroforestry in Hill Ecosystem of Bangladesh* was organized during 19-20 June 2014 at BARC conference room-1. The objectives of the workshop were to identify the problems, prospects, research activities and development of agroforestry in hill ecosystem, develop the concept of hill agroforestry, acquainted with the tools of hill agroforestry, disseminate the technologies of hill agroforestry and future research strategies for hill agroforestry production and utilization. Seventy five participants of 30 organizations participated in the workshop.

Coordinated World Food Day Seminar

Coordinated World Food Day Seminar was held on 24 October 2013 at BARC auditorium, Farmgate, Dhaka. The Seminar was presided by Secretary, Ministry of Agriculture Mr. Monjur Hossain, Honorable Agriculture Minister Motia Chowdhury, MP was the Chief Guest. The slogan was *Healthy People Depends on Healthy Food System* and the theme of seminar was *Sustainable Food Systems for Food Security and Nutrition*.

Research Review 2013 and Programme Planning Workshop 2014 of Forestry Research Activities in Different Institutes and Universities

A two-day workshop on “Research Review 2013 and Programme Planning Workshop 2014 of Forestry Research Activities in Different Institutes and Universities” was organized during 12-13 March 2014 at BARC conference room-1. The objectives of the workshop were to review the forestry research activities of 2013, identify the problems, prospects, research activities and development of forestry in Bangladesh and future forestry research planning for 2014 in Bangladesh. Seventy participants of 30 organizations participated in the workshop.

Research Review 2013 and Programme Planning Workshop 2014 of Agroforestry Research Activities in Different Institutes and Universities

A two days workshop on “Research Review 2013 and Programme Planning Workshop 2014 of Agroforestry Research Activities in Different Institutes and Universities” was organized during 09-10 April 2014 at BARC conference room-1. The objectives of the workshop were to review the agroforestry research activities of 2013, identify the problems, prospects, research activities and development of agroforestry in Bangladesh and future agroforestry research planning for 2014 in Bangladesh. Seventy participants of 30 organizations participated in the workshop. All the six partner organizations of the SPGR sub-project presented the progress of their respective activities in 2013 and the planned activities in 2014 and different organizations were presented, discussed and developed in the workshop.

Training workshop on Medicinal Plants of Bangladesh (Collection, Cultivation, Preservation and Utilization)

A two days training workshop on “Medicinal Plants of Bangladesh (Collection, Cultivation, Preservation and Utilization)” was organized during 23-24 March 2014 at BARC conference room-1. The objectives of the training workshop were to identify the problems, prospects, research activities and development of medicinal plants, disseminate the technologies of medicinal plants and identify future research strategies for medicinal plants production and utilization. Seventy five participants of 35 organizations participated in the training workshop. Thirteen research paper was presented in the training workshop. All the six partner

organizations of the SPGR sub-project presented the progress of their respective activities in 2013 and the planned activities in 2014 and different organizations were presented, discussed and developed in the workshop.

Project Completion Report (PCR) Presentation Workshop

PIU BARC and Forestry unit jointly organized a Project Completion Workshop on the SPGR Sub Project “Improvement of Agroforestry Practices for Better Livelihood and Environment” and “Enrichment and conservation of Mangrove Ecosystem” on 12 and 27 May 2014 at BARC. All the six partner organizations of the SPGR Agroforestry sub-project presented their Project Completion Report (PCR).

Agricultural Engineering, NRM

Agricultural Engineering Technology

Agricultural Engineering Section, BARC and Farm Machinery and Postharvest Process Engineering Division, BARI jointly organized 2 (two) batches of training courses on *Agricultural Engineering Technology (Use of Farm Machinery and Efficient Irrigation System Management)* at BARI, Gazipur. The objective of this training was to awareness development about the technologies available in NARS institutes to Agricultural Engineers, working DAE and NARS institutes. Forty Agricultural Engineers from DAE are participated in two batches of the training. First batch of the training was held 5th April to 8th April 2014. Inaugural session was chaired by Engr. Shoeb Hassan, CSO (FMP. Engg.), BARI. Dr. Sultan Ahmmed, CSO (Agril. Engg.), BARC was present as Chief Guest.

Second batch of the training was held 19th April to 22th April 2014, at BARI, Gazipur. Inaugural session was chaired by Engr. Shoeb Hassan, CSO (FMP. Engg.), BARI. Dr. Md.Rafiqul Islam Mondol, Director General, BARI was present as Chief Guest.

NARS Research Planning Workshop on Agricultural Engineering

A two-day NARS Research Planning Workshop on Agricultural Engineering was held on 21-22 May 2014 at BARC, Dhaka Bangladesh. Workshop evaluated of Agricultural Engineering Research Reports (2013-14) and Planning Future Research Program (2014-15) of NARS Institutes. The workshop was organized by the

Agricultural Engineering Section, Natural Resources Management (NRM) Division, BARC. The objectives of the workshop were to review the status and needs of agricultural engineering research in Farm Machinery, Irrigation & Water Management and Postharvest Technology. Ninety Agricultural Engineers from NARS Institutes, universities and other organization participated in the workshops. Participants offered valuable suggestions and recommendations in various issues on i) Farm Machinery, ii) Irrigation and Water Management iii) Postharvest Technology.

Soils

Use of Fertilizer Recommendation Guide 2012

Soils Unit of Natural Resources Management Division organized different training program for NARS scientists, DAE Officers and junior teachers of universities. Three batches of training program on *Use of Fertilizer Recommendation Guide 2012* were conducted during 30 March-01 April 2014, 27-29 April 2014 and 25-27 May 2014. A total of forty NARS scientists, extension officers and lecturer/assistant professors of different universities participated in each batch of the training program. Another training program was organized on Agricultural Land Management for Improving Soil fertility and Water use Efficiency under AFACI project on 1-2 October 2013. The scientists of the Unit took part in sharing knowledge with the participants of these programs and provided with comments, suggestions etc. especially in the workshops and seminars. The scientists also took part in a number of discussion meetings with the foreign delegates visiting BARC.



Training on Use of Fertilizer Recommendation Guide 2012

Annual Review workshop of Coordinated Project on Soil Fertility and Fertilizer Management for Crops and Cropping Patterns

Annual Review workshop of Coordinated Project on Soil Fertility and Fertilizer Management for Crops and

Cropping Patterns was held at Bangladesh Agricultural Research Council, during 21-22 April 2014. This is a coordinated sub-project comprising of eight research components (OFRD, BARI and SSD of BARI, BRRI, BINA, BSRI, BJRI & BAU; and SRDI) and BARC works as a coordinating agency. Project activities include soil testing and field trials on fertilizer requirements for a range of crops (field crops, vegetables, fodder & inter crops) and major cropping patterns covering about twenty AEZs of the country mainly in floodplains and terraces. In this workshop, all PIs of respective components presented their research activities. The aims of the workshop were to evaluate the progress of the project activities of each component with the view to formulate and update fertilizer recommendation for crops and cropping patterns. One research component (BAU) is specifically involved in evaluating micronutrient requirement for different crops in six (6) different AEZs.

A national workshop on Launching of Fertilizer Recommendation Guide 2012 was held on 7 November 2013. High officials of Ministry of Agriculture, NARS institutes, DAE and senior soil scientists of NARS institutes and universities participated the workshop. Begum Motia Choudhury MP, Minister for Agriculture, Peoples Republic of Bangladesh was the chief guest of this grand workshop.



Hon'ble Agriculture Minister Begum Matia Chowdhury unveiling the cover of FRG

AERS

Selected Software Tutorial for Econometric Analysis

AERS division organized a Training Programme on *Selected Software Tutorial for Econometric Analysis*, which was held during 25-29 May 2014 at Computer & GIS Unit of Bangladesh Agricultural Research Council. A total of 15 participants including scientists and

teachers of NARS institutes and universities, respectively attended in the training programme. Four sophisticated econometric tools namely STATA, Frontier Model, SHAZAM and E-views-7 were introduced and practiced by the participants during the training periods.

Review of Socio-economic Research Programmes of NARS Institutes

A workshop on *Review of Socio-economic Research Programme (2013-2014) and Future Research Programme (2014-2015) of NARS Institutes* was held on 26 June 2014 at Bangladesh Agricultural Research Council. In the inaugural session Mr. Md. Anwarul Islam Sikder (ndc), Chairman, BADC was presented as the Chief Guest and Dr. S. M. Khalilur Rahman, Member-Director (AERS), BARC presided over the session. A total of 80 participants including scientists, professors, agriculture experts and delegates attended the workshop from different research organizations, universities and private sectors. The present and future research activities presented by the Head or nominee of the related division of NARS institutes. Two technical sessions were presided over by Dr. Jahangir Alam, Ex Director General, BLRI and Dr. Md. Abul Kashem, Ex Senior Research Fellow, BIDS, Dhaka. Following suggestions/recommendations were made by the house from the whole day workshop:

Bangladesh Agricultural Research Institute Comments/Suggestions on Present (2013-14) Programmes:

- (1) Research summary should be presented in the way of policy implication.
- (2) Reasons behind the decreasing trend of sweet potato should be identified.
- (3) Post harvest losses in cultivation stages must be estimated.
- (4) Research progress of Agricultural Economics Division should be presented by following fiscal year like BARC.

Comments/Suggestions on Future (2014-15) Programmes:

BARI-3. An economic analysis of yield gaps in major oilseed crops in Bangladesh

- Yield gap II and III should be estimated.
- Quantitative regression can be used to estimate yield gap.
- Yield gap estimation procedure should be included in methodology section.
- Regional variation should be included.

BARI-4. Farmers choice and marketing constraints of BARI released variety in seed market

- Crop must be specified considering importance in the national context.
- Competitive price and yield difference should be considered.
- Concept note for research grant from BARC should be submitted by 10 July, 2014.

BARI-5. Seasonal food insecurity in *monga*-prone areas of Bangladesh

- The term “*monga*” should be avoided because the *monga* itself is seasonal term.
- Food lean period can be used instead of *monga*.
- For further improvement, discuss with Prof. Dr. R.K. Talukder and Prof. Dr. S.A. Sabur.

BARI-6. Impact of agricultural mechanization adoption of maize production in Bangladesh

- Agricultural machinery should be specified.
- Discriminate analysis can be included.
- Import and supply side can be taken under consideration.

BARI-8. Sunflower cultivation in Bangladesh: A profitable options for fallow land utilization

- Considering the fallow land, the study should be modified.

BARI-10. Economics of strawberry: Offering a new opportunity to the farmers of Bangladesh

- Economic study on capsicum can be undertaken instead of strawberry.

BARI-12. Economic loss assessment of vegetable cultivation due to biotic stresses in southern part of Bangladesh

- Both biotic and abiotic stress factor should be considered.
- Research on agricultural adoption to climate change can be conducted.

Bangladesh Rice Research Institute

Comments/Suggestions on Present (2013-14) Programmes:

- (1) Research operational cost must be increased.
- (2) Policy research should be undertaken according to national demand.
- (3) Comparative research programme should be undertaken between Rice and Maize production.

Comments/Suggestions on Future (2014-15) Programmes:

BRRI-1. Impact of Seasonal Credit on MV Boro Rice Cultivation in Some Selected Areas of Mymensingh

- The study should be stopped.

BRRI-6. Evaluating the Technical Efficiency of Rice Farmers under Boro season in Bangladesh

- Other season such as Aman should be included.

Bangladesh Institute of Nuclear Agriculture

Comments/Suggestions on Future (2014-15) Programmes:

BINA-2. Field level comparative Analysis of Borodhan 7 and BRRI dhan 33 (2013-14)

- The calculation of cost and return such as BCR should be checked.
- Economic analysis on earliness of BINA dhan 7 over BRRI dhan 33 should be done.

Bangladesh Livestock Research Institute

Comments/Suggestions on Present (2013-14) Programmes:

- Variety-wise profitability of fodder should be estimated.
- Impact study of the developed technologies must be undertaken on priority basis.

General Comments and suggestions

- Institutional support and national need based in depth research should be conducted.
- In depth study on agribusiness aspect should be undertaken.

- Some study should be done in group with the help of BAU, Mymensingh.

Computer and GIS

During the period 2013-14, four training programs as listed below are organized:

1. Training on *ICT for Effective Office Management*. 5 days (24-30 April, 2014). 30 (Thirty) officers of BARC, held in Computer & GIS Unit, BARC.
2. Training on *Cisco Certified Network Associate (CCNA)*. 10 days (03-12 June, 2014). 14 (Fourteen) Officers of NARS and BARC, held in Computer & GIS Unit, BARC from PIU-NATP, BARC fund
3. Training on *ICT for modern office management*. 10 days (15-19 June and 22-26 June, 2014). 40 (20+20) Staff of NARS and BARC, held in Computer & GIS Unit, BARC from PIU-NATP, BARC fund.
4. Training on *Crop Suitability Assessment Model (CSAM)*. 2 days (28-29 June, 2014). 20 (Twenty) Officers of NARS and BARC, held in Computer & GIS Unit, BARC from PIU-NATP, BARC fund under SPGR Sub-project, BARC

Nutrition

During the year 2013-2014, Bangladesh Agricultural Research Council (BARC) and Bangladesh Institute of Research and Training on Applied Nutrition (BIRTAN) jointly organized 5 training programme under the support of core research fund of BARC. The training topics, duration, number. of participants and venue of the training programme are presented below:

Information on training implementation by the BARC coordination unit (2013-14)

Sl. No	Topic	Venue	Duration with date	No. of participants
1.	Awareness building on the importance of nutrition information	DAE Conference Room, Barisal	3 days 24 – 26 April 2014	30
2.	Awareness building on the importance of nutrition information	Rohanpur Upazilla parishad, Chapainababgonj	2 days 15 – 17 June 2014	30
3.	Quality processing and Preservation of Agro-products	DAE Conference Room, Khagrachari	3 days 27- 29 march 2014	30
4.	Quality processing and Preservation of Agro-products	BIRTAN Head office, Dhaka	5 days 16-20 June 2014	30
5.	Quality processing and Preservation of Agro-products	Bagaichari, Rangamati	3 days 22- 24 June 2014	30

A total of 30 participants were attended in each batches of the training programme. In the first programme, course was organized to disseminate the messages focusing on food based nutrition with the view that acquired knowledge would be transferred to the students, which might be transmitted to the family members and neighbours. In the second programme, local small entrepreneurs & NGOs representatives in particular were participated. This course was conducted with the view to improve their skill and knowledge in food processing and preservation technique under hygienic condition of perishable fruits and vegetables.

It is noted that the courses were designed with multidisciplinary sectors covering the following areas viz., agriculture products, fishery, food hygiene, sanitation, safe food and food security, food adulteration and mitigation, improvement of nutrition level, arsenic problems, processing and preservation techniques of fruits and vegetables, quality control, etc. were emphasized.

In Barisal, Bagaichari and Chapainababgonj programmes, Dr Md. Monirul Islam, Director (Nutrition) of BARC was present as chief guest in different sessions of inaugural and certificate giving ceremony. The Deputy Director of DAE in respective districts and Mr. Mahfuzur Rahman, PSO of BIRTAN were present as special guest. However, Mr. Mosharaf Hossain, Executive Director (BIRTAN) was present as chief guest in inaugural and certificate giving ceremony of the programme held in BIRTAN Head office, Dhaka. In addition, Mr. Mozzamel and Mr. Jotilal Barua Scientific personnel from BIRTAN were also present to facilitate and make the entire training programme successful.

However, under the SPGR sub-project, to create awareness among the different stakeholders regarding food safety measures and protocols particularly for meat and dry fish/fish products. BARC coordination unit during the reporting period implemented two training programs at different locations of the country.

Workshop on Chemicals/Pesticides Uses in Fruit Production: Health Hazards and Consumers Awareness

During the reporting period the Nutrition Unit, BARC organized a workshop at Rohanpur, Chapainababgonj on “ *Chemicals/Pesticides Uses in Fruit Production: Health Hazards and Consumers Awareness*” on 17.06.2014. Mr. Jamshed Ahamed Khondaker, Joint Secretary (Research), Ministry of Agriculture and

Local Upazilla Vice Chairman was present as chief guest and special guest respectively in the programme. The participants of the workshops were mainly the mango growers, traders, pesticide dealers of the greater Rajshahi districts, local journalist and members of the Volahat mango foundation.

However, another two special workshops were organized by BIRTN on *Uses of Chemicals in Foods and its Effects on Human body* held on 26.04.2014 and 31.05.2014 at the DAE Conference Room, Barisal and DAE Conference Room, Cox’s Bazar respectively (Table 3). In both programmes, key note paper of was presented by Dr. Md. Monirul Islam, Director (Nutrition), BARC. In the first programme, Additional Director, DAE, Barisal was present as chief guest and in other workshop, Mr. Mosharaf Hossain, Executive Director, BIRTAN and Mr. Ruhul Amin, Deputy Commissioner, Cox’s Bazar were present as chief guest and special guest respectively. The participants of the workshops were mainly the Upazilla agriculture officers in greater cox’s Bazar districts including reporters from the print and electronic media.

Manpower Development Activities

During the period, 6195 scientists/officers from the NARS institutes/Ministry of Agriculture participated in the NATP/Revenue funded training/workshop/higher study/study visit programs at home and abroad. It may be mentioned that 1216 scientists/officers attended the revenue funded training/workshop/ higher study programs while the remaining 4979 scientists/officers participated in the NATP funded training/workshop/higher study/study visit programs at home and abroad. The major activities that Manpower and Training Unit has accomplished/ helped implementation during the reporting period are delineated below.

Foundation Training

The Foundation Training Course for the 24th batch of the National Agricultural Research System (NARS) scientists was held at Bangladesh Academy for the Rural Development (BARD) in Comilla. The course duration was four months from November 10, 2013 to March 9, 2014 in which 40 officers took part. The program was conducted by BARD Comilla and sponsored by BARC, Dhaka. The newly recruited Scientific Officers from different NARS institutes were the participants in this course.

Training activities organised by BARC-BIRTAN



The main objective of the course was to create a base for developing a corps of well-groomed NARS scientists, dedicated to the welfare for the nation and people in a changing global context. This four-month long training course contents include major five areas including Bangladesh Studies, Public Administration, Development Economics, Skill Development and other modules in promising areas.

The program was financed by PIU-BARC: NATP Phase I.

Training Program on Administrative and Financial Management

BARC organized a 14- day training program on Administrative and Financial Management during 4-17 May, 2014 at Bangladesh Academy for Rural Development, Kotbari, Comilla. A total number of 40 PSOs and CSOs from different NARS institutes participated in the program. The objective of the training program was to provide these senior level scientists/ researchers with the modern concepts of administrative and financial management system.

Training on Research Methodology

Under revenue funding BARC organized two training programs on Research Methodology at Graduate Training Institute (GTI) of Bangladesh Agricultural University, Mymensingh. The duration of each of the training program was 13 days and each of the training program was attended by 30 junior level NARS scientists. The two training programs were held during 3-15 May 2014 and April 19 to May 31, 2014 respectively.

The objective of this training program is (1) to equip the participants with necessary knowledge and skill in planning, execution, monitoring and evaluation of research activities (2) develop analytical skill of participants in data compilation, data interpretation and report preparation (3) enable the trainees in writing and reviewing scientific articles of international standard and (4) upgrade the skill of the researchers in writing research proposal and manage the project effectively.

In Country PhD (Revenue)

One of the major tasks of Manpower of Training Unit of BARC is to offer higher studies for NARS scientists in various disciplines of agriculture. Eighteen (18) NARS scientists who started PhD research in the fiscal

2008-2009, have completed their research. Meanwhile, during the current fiscal 20 scientists have been selected from the NARS institutes for the revenue funded in-country PhD Program and in the meantime all the PhD scholars have taken admission in the universities as prescribed by the PhD Selection Committee of BARC. The financial management and performance monitoring activities in this connection are being carried out as usual.

In Country PhD (CSISA-BARC Scholarship Program)

There was a provision of five slots for in-country PhD under CSISA-BARC Scholarship Program. All the five PhD researchers - one from BARC and two from BARI, one from BINA and another from BFRI (fisheries) are involved with their PhD research activities. The program is being jointly funded by IRRI, CIMMYT and WorldFish Centre under CSISA-BD project.

In Country PhD (PIU-BARC): NATP Phase 1

Under PIU-BARC, NATP: Phase-1 there were provisions of 60 national PhD scholarships in various fields of agriculture in the country. During the reporting period 30 PhD researchers have completed their study while the remaining will complete by 2014. All costs in connection with their PhD programs were provided timely in their respective universities. All the 60 PhD researchers were sent to different universities abroad under Literature Review Program. In addition, under SPGR sub-projects nineteen scholars are pursuing their PhD degree in different universities in Bangladesh and their study will also be completed by 2014.

Foreign PhD (PIU-BARC) NATP

Under the PIU-BARC: National Agricultural Technology Project (NATP) Phase-1, 30 slots were earmarked for foreign PhD programs for the scientists of National Agricultural Research System (NARS) in the countries like Malaysia, Thailand, China, Philippines, India and Sri Lanka. On receipt of progress reports scholars' allowances and research grants are being released. Majority scholars have completed their PhD program and the remaining will complete by 2014. It is hoped that the scholars through their knowledge in agriculture gained abroad would enrich and accelerate the scientific advancement in Bangladesh agriculture.

Post-Doctoral Fellowships Abroad

As per provision of the RDPP of NATP Phase –I, there were 10 slots for post-doctoral fellowships for a period ranging from 6-8 months of which all 10 post-doctoral fellowships were selected for developing /developed countries. All the ten scholars have already completed their post-doctoral fellowships.

Foreign Training/Seminar/Workshop/Study Tour

During the reporting period other than in country

activities, Manpower and Training Unit also initiated and implemented foreign training/seminar/workshop /meeting in different countries of the globe. A total number of 10 research managers/scientists/personnel under different fields of agriculture and cross cutting issues attended to help enrich their professionalism in order to achieve the country's ultimate goal to ensure food security in the country. Detailed activities are furnished below:

Sl. No	Name, Desig. & Org.	Name of Program	Duration	Country	Funding org.
01	Dr. Shaikh Mohammad Bokhtiar, PSO (Soils), BARC	International Conference Commemorating 50 years since Barlaug's First visit to South Asia: A Retrospective and Perspective of the Green Revolution	16-17 August 2013	India	CIMMYT/ APAARI
		AFACI Expert Workshop on "Agro-meteorological Information for the Adaptation to Climate (AIMS)"	03-07 June 2014	Mongolia	AFACI
02	Md. Mustafizur Rahman Senior Tr. Officer, BARC	CABI Plantwise: Regional Workshop	8-9 Nov 2013	India	CABI
03	Dr. Wais Kabir, Executive Chairman, BARC	9th Governing Council: Centre for Sustainable Agricultural Mechanization (CSAM)	19 Nov 2013	Thailand	NATP
		Expert Consultation on Strengthening Linkages between Research and Extension to Promote Food and Nutrition Security	11-12 December 2013	Thailand	FAO-FAP, CAPSA-UNESCAP
04	Dr. Md. Mohammad Shahjahan, CSO (Forestry), BARC	Expert Consultation on Promotion of Medicinal Plant and Aromatic Plants in Asia and Pacific Region	2-3 December 2013	Thailand	APAARI
05	Dr. Khalequzzaman Akand Chohwdhury, MD (Crops), BARC	28 th . Meeting of the Working Group on the Harmonization of Regulatory Oversight in Biotechnology and 21 Meeting of the OECD Task Force for the Safety of Novel Foods and Feeds	6-13 February 2014	France	CERA
		Workshop on "Ensuring Biosafety through legal and regulatory instruments : South Asian Perspective"	27-29 May 2014	Nepal	Bhutan Govt.
06	Dr. Mian Sayeed Hassan, PSO (Crops), BARC	AFACI Expert Workshop on Establishing of Network and Model Manual on Postharvest Technology of Horticultural Crops in Asia	11-15 March 2014	Lao PDR	AFACI
07	Dr. Md. Kamal Uddin Executive Chairman, BARC	AFACI 3 rd . General Assembly	23-25 April 2014	Hanoi, Vietnam	RDA, Republic of Korea
08	Dr. Paresh Chandra Golder MD (P & E), BARC	NUFFIC-Funded NICHF-BDG-156 Project Meeting	3-14 May 2014	Netherland	NICHF-BDG-156 Projec
09	Dr. Md. Aziz Zilani Chowdhury, CSO (Crops), BARC	Workshop on <i>Ensuring Biosafety through legal and Asian Perspective</i>	27-29 May 2014	Nepal	Bhutan Govt.
10	Dr. Sultan Ahmmed MD(NRM), BARC Dr. Sultan Ahmed MD(NRM), BARC	High Level Multi-Stakeholder Consultation on the Sustainable Agricultural Mechanization in Asia and the Pacific	26-27 June 2014	Thailand	Not known, nomination sought from the MoA
		AFACI Expert Workshop on "Agricultural Land Management for Improving Soil Fertility and Irrigation Efficiency"	08-13 June 2014	Jeju Islands, Korea	AFACI

In-country Training/Seminar/Workshop (Revenue)

During the reporting period 13 training programs and 8 workshops were arranged by different divisions / units /

centre of BARC under revenue funding in which 1216 scientists/officers took part.

Division/ Unit	Topic	Venue	Duration	No. of Participant
Crop	Knowledge and Awareness Building on Agricultural Policies of Bangladesh	BARC	(2 days January/14)	40
Forestry	Training on Forestry Technologies for Professionals (BARC, DAE, BFIDC, BARI, DF, Universities, NGOs)	BARC	2 days Dec./13	60
	Training on Agroforestry Technologies for Professionals (BARC, DAE, BJRI, BFIDC, BARI, DF, Universities, NGOs)	BARC	2 days Dec./13	60
Nutrition	Training on Awareness building on the Importance of nutrition information	BIRTAN District Level	29 Mar-2 Apr, 2014 6-10 April, 2014 20-24 April 2014 30x3 batches	90
	Training on Quality Processing and preservation Agro-products.	BAN-HRDB District Level	4-8 May 2014 25-29 May 2014, 15-19 June 2014 30 x3 batches	90
	Training on Selected Software Tutorial for Economic Analysis	BARC	25-29 May 2014	15
	Training on Financial Management including Vat & Tax for Officers (up to the level of Director/CSO)	BARC	19-21 June 2014	50
	Training on Financial Management and Project Accounting Procedure for NARS Accounts Personnel	BARC	06-08 June	40
M&T	Administrative and Financial Management for PSO/CSO level Officers	BARD	4-17 May 2014	40
	Training on Research Methodology	GTI	03-15 May 2014	29
AIC	Training Course on 'Technical Operation and Shooting using Digital Movie Camera (2 Batches)	BARC	8-12 June 2014	08
Fisheries (BFRI, Khepupara	Environmental Friendly Shrimp Culture & Improved Fish Culture and Management	BFRI, Khepupara	4 batches (2+2) 6-7/6/14, 9-10/6/14 12-13/6/14 16-17/6/14	60
	Total			612

Seminar/workshop Activities: (Revenue)

Division/ Unit	Activity	Venue	Duration	No. of Participant
Crops	Review Workshop on Crop Improvement Programme: Research Progress 2012-13 & Research Programme 2013-14	BARC	21-22 October 2013	64
AERS	Review of Socio-Economic Research Programs of NARS Institutes	BARC	26 June 2014	80
	Research Review and Planning Workshop of Soils Program of NARS Institutes	BARC	19-21 Nov. 2013	80
Forestry	Review Workshop on Agro-forestry Research Activities of different NARS Institute & Universities.	BARC	9-10 April 2014	70
	Review workshop on Forestry Research Activities of BFRI and other Universities (CU, KU, SSTU etc.) and others	BARC	-	70
P&E	Annual Work plan Review Workshop.	BARC	29 July, 2013	50
	Field Monitoring Workshop of Research Grant Project	BARC	June 8, 2014	90
NRM Ag. Eng.	Agricultural Engineering Research Planning Workshop	BARC	21-22 May 2014	100
				604

PIU-BARC: NATP Phase 1 Funded Training/Workshop/Seminar

from the NARS institutes, extension departments, universities and Ministry of Agriculture.

During the reporting period 29 training programs were organized in which 941 officers / scientists took part

Implementation Status of local training under PIU-BARC, NATP: Phase-1 in 2013-2014.

Sl.	Name of Training	Duration	Number Participants	Venue
1.	Administrative and Financial Management for PSO/CSO of NARS	27 October to 09 November 2013	40	BARD, Comilla
2.	Fundamentals of Technological Innovation in Organizations	01-09 November 2013	01	BIM, Dhaka
3.	Foundation Training for Junior scientists	06 November 2013 to 05 March 2014	40	BARD, Comilla
4.	Designing and Implementation of On-Farm Research	16-21 November 2013	60	BARI, Gazipur
5.	Capacity enhancement of NARS through ICT and MIS application	21 November 2013	60	Conference Room-1, BARC
6.	Financial Management and Procurement	28 November to 02 December 2013	45	Training Hall, BARC

7.	Financial Management and Procurement	03-07 December 2013	45	Training Hall, BARC
8.	Financial Management and Procurement	17-21 December 2013	45	Training Hall, BARC
9.	Financial Management and Procurement	22-26 December 2013	45	Training Hall, BARC
10.	Research Methodology	01-13 March 2014	30	GTI, Mymensingh
11.	Transfer of Technology (ToT): Cotton Technologies	11-13 March 2014	30	CDB, Dhaka
12.	Research Methodology	19 March -01 May 2014	30	GTI, Mymensingh
13.	Impact Assessment of Agricultural R&D		20	BARI, Gazipur
14.	Impact Assessment of Agricultural R&D		20	BARI, Gazipur
15.	Fertilizer Recommendation Guide 2012	30 March- 01 April 2014	40	Conference-1, BARC
16.	Transfer of Technology (ToT): Jute Technologies		30	BJRI, Dhaka
17.	Transfer of Technology (ToT): Sugarcane Technologies		30	BSRI, Ishurdi, Pabna
18.	Phytosanitary and Food Safety related Issues	02-03 April 2014	40	Conference Room-1, BARC
19.	Use of Farm Machinery and Efficient Irrigation System Management	08-11 April 2014	20	BARI, Gazipur
20.	Use of Farm Machinery and Efficient Irrigation System Management	19-22 April 2014	20	BARI, Gazipur
21.	Project Development and Management	20-24 April 2014	30	Conference Room-1, BARC
22.	Seed Quality Management	06-08 May 2014	40	Training Hall, BARC
23.	Transfer of Technology (ToT):Sericulture	11-13 May 2014	20	BSRTI, Rajshahi
24.	Training on ICT for Modern Office Management		24	Computer Center, BARC
25.	Training on Basic Office Management		34	Training Hall, BARC
26.	Training on ICT for Modern Office Management		24	Computer Center, BARC
27.	Training on Basic Office Management		34	Training Hall, BARC
28.	Research Methodology and Office Management		30	BFRI, Mymensingh
29.	Cisco Certified Network Associate (CCNA) (Routing & Switching)	03-12 June 2014	14	Computer Center, BARC
			941	

Seminar/Workshop (NATP)

During the reporting period 48 events of national seminars/workshops in various fields of agriculture were organized with the support of the concerned divisions of BARC and NARS. In the seminars/workshops 3352 participants were present from the

NARS institutes viz. BARI, BRRI, BJRI, BINA, BFRI (Fisheries), BFRI (Forest), BSRI, BLRI, BTRI, SRDI including BARC.

Implementation Status of Local Seminar/Workshop under PIU-BARC, NATP: Phase-1

Sl. No	Name of seminar/workshop	Date	No. of Participants	Venue
1.	Progress Review Workshop of SPGR under AERS	23 September 2013	60	BARC Conference Room
2.	Review Workshop on M&E activities in the NARS	02 December 2012	90	--Do--
3.	Rationalization studies: Institutional Reform and Research Management	24 February 2014	75	--Do--
4	Training Workshop on Medicinal Plants of Bangladesh (Collection, Cultivation, Preservation and Utilization	23-24 March 2014	75	--Do--
5	Workshop on SPGR Sub-Project Completion Report	06 April 2014	65	--Do--
6	Workshop on SPGR Sub-Project Completion Report	13 April 2014	65	--Do--
7	Workshop on SPGR Sub-Project Completion Report	16 April 2014	60	--Do--
8	Workshop on SPGR Sub-Project Completion Report	20 April 2014	65	--Do--
9	Workshop on SPGR Sub-Project Completion Report	21 April 2014	70	--Do--
10	Workshop on SPGR Sub-Project Completion Report	22 April 2014	65	--Do--
11	Workshop on SPGR Sub-Project Completion Report	28 April 2014	70	--Do--
12	Workshop on SPGR Sub-Project Completion Report	30 April 2014	60	--Do--
13	Workshop on SPGR Sub-Project Completion Report	04 May 2014	85	--Do--
14	Workshop on SPGR Sub-Project Completion Report	06 May 2014	65	--Do--
15	Workshop on SPGR Sub-Project Completion Report	11 May 2014	65	--Do--
16	Workshop on SPGR Sub-Project Completion Report	12 May 2014	75	--Do--
17	Workshop on SPGR Sub-Project Completion Report	14 May 2014	75	--Do--
18	Workshop on SPGR Sub-Project Completion Report	15 May 2014	72	--Do--
19	Workshop on SPGR Sub-Project Completion Report	18 May 2014	60	--Do--
20	Workshop on SPGR Sub-Project Completion Report	19 May 2014	60	--Do--
21	Workshop on SPGR Sub-Project Completion Report	20 May 2014	70	--Do--
22	Internal Research Review Workshop	21-22 June 2014	60	CDB HQ, Dhaka
23	Regional Research-Extension Review and Programme Planning Workshop 2014 (Dhaka)	21-22 May 2014	70	BARI, Gazipur
24	Regional Research-Extension Review and Programme Planning Workshop 2014 (Rajshahi)	25-27 May 2014	80	RWRC, BARI, Rajshahi
25	Regional Research-Extension Review and Programme Planning Workshop 2014 (Rangpur)	26-28 May 2014	80	RARS, BARI, Rangpur
26	Regional Research-Extension Review and Programme Planning Workshop 2014 (Jamalpur)	26-28 May 2014	70	RARS, BARI, Jamalpur
27	Regional Research-Extension Review and Programme Planning Workshop 2014 (Jessore)	25-27 May 2014	80	RARS, BARI, Jessore
28	Regional Research-Extension Review and Programme Planning Workshop 2014 (Barisal)	27-29 May 2014	70	RARS, BARI, Barisal
29	Regional Research-Extension Review and Programme Planning Workshop 2014 (Chittagong)	28-30 May 2014	60	RARS, BARI, Chittagong
30	Regional Research-Extension Review and Programme Planning Workshop 2014 (Comilla)	27-28 May 2014	30	RARS, BARI, Comilla
31	Regional Research-Extension Review and Programme Planning Workshop 2014 (Sylhet)	27-28 May 2014	30	RARS, BARI, Moulovibazar
32	Regional Research-Extension Review and Programme Planning Workshop 2014 (Chittagong Hill Tract)	03-04 June 2014	35	RARS, BARI, Khagrachari
33	BARI Technology Transfer workshop		90	BARI, Gazipur
34	Workshop on SPGR Sub-Project Completion Report	25 May 2014	65	BARC Conf. Room
35	Workshop on SPGR Sub-Project Completion Report	26 May 2014	65	--Do--
36	Workshop on SPGR Sub-Project Completion Report	27 May 2014	70	--Do--
37	Workshop on SPGR Sub-Project Completion Report	05 June 2014	65	--Do--
38	Workshop on SPGR Sub-Project Completion Report	09 June 2014	65	--Do--

39	Workshop on SPGR Sub-Project Completion Report	10 June 2014	65	--Do--
40	Consultation meeting for the Inception on Identification of rice varieties tolerant to abiotic stress	10-11 June	80	--Do--
41.	Diversity of Adaptive Fishing Gear and their Impacts on Riverine and Environment		100	--Do--
42	Use, health hazard and awareness of Chemical in Fruits production	17 June 2014	90	RHRS, Chapai Nababgongj
43	Agroforestry in Hill Ecosystem of Bangladesh	19-20 June 2014	75	BARC Conf. Room
44.	External Review of Cotton Development Activities	21-22 June 2014	100	HQ, CDB, Dhaka
45	Workshop on Preparation of National Strategy Plan for Control of PPR on Goat	03-04 June 2014	60	BARC Conf. Room
46	Annual Research Progress Review and Proposal of New Projects		60	--Do--
47	Awareness building Chemical use in Agricultural products	26 June 2014	100	--Do--
48	6 th Meeting of the Asian Cotton Research and Development Network	18-20 June	120	Rose Garden Inn, Banani
			3352	

Foreign Short-term Training/Seminar/Workshop/Study Visit

During the period, 32 scientists/officers attended short-term training program, 72 attended study visit program while 15 joined seminar/workshop abroad under NATP funding

Supported Organizing Following Events

- Global Yield Gap Atlas (GYGA) project briefing and interaction workshop was held at BARC Conference Room, Dhaka at 10.00am on Wednesday, October 30, 2013. The workshop was hosted by the Wageningen University, Netherlands and co-hosted by the University of Nebraska – Lincoln, The United States in collaboration with BARC. The Manpower and Training Unit, BARC provided all-out cooperation in organizing this meeting on behalf of BARC.
- Opinion exchange meeting on Soil Fertility and Fertilizer Management was organized at BARC Conference Room on November 26, 2013 by the M&T Unit, BARC. The meeting was organized in connection with the BARC visit of Dr. Prem S. Bindraban, Executive Director of Virtual Fertilizer Research Center (VFRC), IFDC.
- A four member delegation from the Council for RNR Research of Bhutan led by Mr. Namgay Wangchuk, Director General of (CoRRB) visited Bangladesh during 10-14 February 2014. In this connection an Opinion Exchange meeting between the Bhutanese delegation and BARC officers was organized by the Manpower and Training Unit,

BARC on February 11, 2014 at BARC Conference Room. The visit was also coordinated by the M&T Unit.

- 2nd CGIAR Advisory Committee (CAC) meeting was held on May 8, 2014 at BARC in Dhaka. The M&T Unit, BARC provided all-out cooperation in organizing this meeting.
- The M&T Unit, BARC also supported in organizing two training programs on 1) SATNET Asia National Training Program on Food Safety and Quality Assurance for Agricultural Trade Facilitation, 1-2 June 2014, Dhaka 2) SATNET Asia National Training Program on Biological Control of Agricultural Pests and Diseases, 3-5 June 2014, Dhaka in collaboration with BARC, at Ascott Hotel, Baridhara, Dhaka.

Visit Abroad

Planning and Evaluation

Dr. Paresh Chandra Golder, Member Director and Dr. M.A. Awal, Principal Scientific Officer Participated in the Seminar/Symposium, Food Fair & Exhibition on the occasion of “Green Week” at Berlin, Germany (11days).

Dr. Paresh Chandra Golder, Member Director also Participated in the 5 days training on “Competences for Integrated Agricultural Research (C-IAR) for Integrated Management of Crop-Fish-Water Resources to Enhance Agricultural Production Systems.” and meetings related to crop-fish-water management, climate change etc. in The Netherlands.

Dr. M.A. Salam completed his post-doctoral study in USA for a period of 8 months.

NRM

Dr. Sultan Ahmmed, MD (NRM) attended the following programmes:

Study visit to Australia during 19 October-01 November 2013 with the financial support of PIU-BARC NATP Project Phase-1

AFACI Expert workshop in South Korea during 8-13 June 2014 with the financial support of AFACI, Korea. High level multi-stakeholder consultation meeting in Thailand during 26-27 June 2014 with the financial support of UNESCAP-FAO CSAM

Study visit to the Agricultural Display Centers in UK and India during 25 September-05 October 2013 with PIU, BARC, NATP: Phase-1 funding

Attended *AFACI ATIN (Agricultural Technology Information Network)* Meeting during 25-29 November 2013 in Cambodia with AFACI Pan-Asia ATIN (Establishment of Agricultural Technology Information Network in Asia) Project funding.

Attended *AgMIP Regional Research Team Finish Line Workshop* during 30 January- 4 February 2014 in Tanzania with AgMIP (Agricultural Model Intercomparison and Improvement Project) funding.

Forestry, NRM

Dr. Mohammad Shahjahan, Chief Scientific Officer attended *Expert Consultation on Promotion of Medicinal and Aromatic Plants in the Asia-Pacific Regions* in Bangkok, Thailand during 2-3 December 2013.

Agricultural Engineering, NRM

Dr. Nazmun Nahar Karim, Principal Scientific Officer, Agril. Engg. Unit Participated in project meeting during 11-12 January 2014 (2 Days) in Nepal sponsored by CIMMYT & Bill & Melinda Gates Foundation.

Soils, NRM

PSO (Soils) attended training on “Modeling Climate Change Impact on Bangladesh Agriculture” held at BRAC-CDM at Rajendrapur, Gazipur during 27 July to 03 August 2013.

PSO (Soils) did Post doctoral research on “Arsenic speciation in rice” in Cornell University, Ithaca, New York, USA during November 2013 to April 2014.

PSO (Soils) attended 20th World Congress of Soil Science held in Jeju Island Korea during 8-13 June 2014.

Computer and GIS Unit

Attended *ESRI International User Conference* during 8-12 July 2013 in USA funding from PIU, BARC, NATP:Phase-1

III. AGRICULTURAL INFORMATION AND PUBLIC RELATIONS

AGRICULTURAL INFORMATION

BARC devotes considerable efforts and resources for the development of an outstanding library collection to meet the expanding needs of agricultural research and to serve as an information resource centre for NARS institutes.

Development of Collection

Until June 2014 the library has a total collection of about 22,900 information materials, which includes books, reports, pamphlets and bound journals etc. The following information materials have been procured during the period under report:

<u>Items</u>	<u>Quantity</u>
Books and Reports	159
Current Journals/Newsletter	78

Literature Search

The Centre renders literature search services from full-text database - The Essential Electronic Agricultural Library (TEEAL) CD database to satisfy the researchers, agricultural scientists, planners and policy-makers. It also provides search services on specific requests received from teachers, students and users from NARS institutes and other organizations. The library provided search service from TEEAL to 151 external users.

Services and Users

During this period 741 users of different categories have used the library. Besides the BARC and NARS scientists, teachers and students of Universities, NGO and private organizational personnel are the users of this library.

Update and Maintenance of databases

- Database on Books and Reports contains 5,709 records out of which 159 records have been added during this year

- Database on Journals, Newsletters, and Periodicals contains 1110 records and being updated regularly.

News Clipping Services

Five hundred ninety nine articles (Bangla and English) have been identified, processed in different format, compiled and prepared a content list and preserved in the library for users.

Online Archive of Important Documents

Developed a database driven online archive based on Content Management Systems (CMS). The database contains digital contents of non-conventional documents of high archival value (Policy documents, Reports of all kinds, Proceedings and other mimeographs). The database contains full text information of about 920 records.

Resource Sharing

The library also performs resource sharing activities to serve the scientists. In this period, the library has collected information materials from FAO, BBS, BANSDOC and all NARS institutes.

AIC also has taken photographs of 40 workshops/training/seminars/meetings and supplied 2063 photos in digital form to the concerned divisions and provided 1,05,298 photocopies of official documents, reports, letters, scientific literature etc. under 4,789 requests.

Activities Relating to BJA

During this period 20 articles have been received from the authors for publishing in the Bangladesh Journal of Agriculture (BJA). The articles have been processed following selecting reviewer/over viewer and making comparison of articles received from reviewers/overviewer after correction made by the authors.

PUBLICATIONS

- খাদ্য দ্রব্যে রাসায়নিকের ব্যবহার: কতটা নিরাপদ? গবেষণা ফলাফল ও উত্তরণের উপায়।
- ভূমির উপযোগীতাভিত্তিক ফসল অঞ্চল, ডিসেম্বর ২০১৩।

৩. পান উৎপাদন কলাকৌশল, ডিসেম্বর ২০১৩।
৪. গ্রীষ্মকালীন টমেটোর জাত ও উৎপাদন প্রযুক্তি, ডিসেম্বর ২০১৩।
৫. দক্ষিণাঞ্চলের উপযোগী কৃষি প্রযুক্তি, নভেম্বর ২০১৩।
৬. Soil Fertility and Fertilizer Mangement Proceedings, 2013

Preparation/Presentation/Publication of Research Articles/Papers

Crops

- Proceeding of the National Workshop: Research Achievement of Past ten Years of Pulses and Oilseeds and Future research Strategies for Sustainable Crop Production.
- Paper presented on “Proliferation of biotechnology/GM products in SAARC region and its consequences – transboundary issue” in South Asian Biosafety Workshop “Ensuring Biosafety through legal and regulatory instruments: South Asian Perspective” held in Bhutan during 27-29 May 2014.

TTMU

- Proceedings of Core Monitoring Workshop, BARC, 2014.
- Training Manual: 1. ToT at BSRI, 2. ToT at BSRTI, 3. ToT at BJRI, 4. ToT at CDB.
- Report: 1. Monitoring Report 2013-14, 2. BARC Annual Report: 2012-13, 3. Annual Progress 2013-14 and Work-plan 2014-15, 4. Budget Report 2014-15.

Planning & Evaluation

- Golder, P.C.; R.K. Sastry and K. Srinivas. 2013. Research Priorities in Bangladesh; Analysis of crop production trends. SAARC J. Agril. 11(1):57-70.

Livestock

- Investigation into *Bacillus anthracis* Spore in Soil and Analysis of Environmental Parameters Related to Repeated Anthrax Outbreak in Sirajganj, Bangladesh. *Thai J Vet Med.* 2013. 43(3): 449-454.
- Proceedings of the *Project Completion Workshop on SPGR Sub-projects under Livestock* (June 2014).
- Proceedings of the *Workshop on Preparation of National Strategy Plan for Control of Peste des Petits Ruminants (PPR)* (June 2014).

Forestry

- Country status report on medicinal and aromatic plants in Bangladesh (2013) Proceedings on Expert Consultation on Promotion of Medicinal and Aromatic Plants in the Asia-Pacific Region, Bangkok, Thailand
- Proceedings of Medicinal Plants of Bangladesh (Collection, Cultivation, Preservation and Utilization)
- Proceedings of Research Review 2013 and Programme Planning Workshop 2014 on Agroforestry Research Activities in Different Institutes and Universities (2014) Forestry Unit, NRM, BARC, Dhaka.
- Proceedings of Research Review 2013 and Programme Planning Workshop 2014 on Forestry Research Activities in Different Institutes and Universities
- Proceedings of the Training on Forestry Technologies for the capacity building of professionals (2013) Forestry Unit, NRM, BARC, Dhaka.
- Existing marketing system and economic analysis of Broom grass (*Thysanolaena maxima* Roxb: Poaceae) (2013) Jour. of Agroforestry and Environment, Vol. 2, No. 1
- Effect of Planting Time and Nitrogen Application on the Yield and Seed Quality of T. Aman Rice (*Oryza sativa* L.) (2013) Bangladesh J. Agril. Res. 38(4): 673-688, December 2013

AERS

- M.M.U. Molla, S. Akhtar, M.K. Alam and A.S.M.A. Huq. 2014. Financial Performance of Traditional Jute Manufacturing Industry in Bangladesh. *Bangladesh Research Publications Journal*. ISSN:1998-2003, Vol. 10, Issue:1, Page: 70-76.
- .S.M. Anwarul Huq, Fatima Mohamed Arshad and Md. Gazi Nurul Islam. 2013. Supply response of wheat in Bangladesh: Cointegration and vector error correction analysis. *African Journal of Agricultural Research*. 8(44): 5440-5446. Available online at <http://www.academicjournals.org/AJAR>. DOI: 10.5897/AJAR10.375, ISSN 1991-637X ©2013 Academic Journals.
- M.M.U. Molla, S. Akhtar, M.K. Alam and A.S.M.A. Huq. 2014. Diversified Jute Product Marketing System in Bangladesh. *International Journal of Business, Social and Scientific Research*. ISSN: 2309-7892, Vol. 1, Issue:3, Page: 219-229.

Nutrition

- Hoq, M. Enamul, M. Alamgir, U. Kulsum, M. Rahman and M. Monirul Islam. 2013. On Drugs and chemicals used in aquaculture practices in Bangladesh. Published in *Bangladesh J. Fish. Res.*, 15-16: 37-48.

IV. ADMINISTRATION AND FINANCE

ADMINISTRATION

Executive Council Meeting

The 8th, 9th, 10th, and 11th meetings of Executive Council of BARC were held on 22 August, 4 December of 2013 and 23 February and 5 April of 2014 respectively in the BARC conference room. The 8th meeting, among other matters, approved 55 SPGR sub-projects along with their revised budget, Bangladesh Jute Research Institute presented their master plan. The Chairman of EC also requested other NARS institutes to send their master plan to BARC. The meeting also discussed the daily rent of the banglow, rest/guest house and dormitory of the NARS institutes. The 9th meeting considered, among others, the approval of the recommendation of promotion/recruitment committee-2 of BARC, time extension of 32 SPGR sub-projects on



Ec Meeting 13-14

no-cost basis, approval of the research programme and budget for 2013-2014 of SRDI, and presentation of master plan of BSRI and BRRI. The 10th meeting considered, among others, the approval of the recommendation of promotion/recruitment committee-1 of BARC, criteria for determining retirement age 62 or 67 for agricultural scientists of NARS institutes, approval of the research programme and budget for 2013-2014 of BARI and BJRI, presentation of master plan of BINA and BARI. The meeting also discussed the enhancement of daily rent of BARC auditorium. The 11th meeting approved the recommendation of promotion/recruitment committee-2 of BARC, discussed the matter relating to the project proposals under PIU-BARC: phase-I Additional fund

of USAID. The meeting also discussed and approved the research proposals and budget of BSRI for 2013-14. The meetings also approved the appointment and promotion of BARC and others NARS institutes' officers.

Appointment/Promotion/Retirement

The following officers have been promoted/appointed during the period:

- Dr. Shah Md. Ziqrul Haque Chowdhury, Principal Scientific Officer (Livestock) has been appointed as Chief Scientific Officer (Livestock) and joined on 9 December 2013
- Dr. Md. Monirul Islam, Principal Scientific Officer (Nutrition) has been appointed as Director (Nutrition) and joined on 6 March 2014.
- Mr. K.M. Ali Haider has been appointed as Assistant Director (Establishment) and joined on 26 May 2014.
- Mr. Md. Jashim Uddin Chowdhury, Senior Assistant Director (Budget) has been promoted to Deputy Director (Establishment) and joined on 8 December 2013.
- Mrs. Susmita Das, Information Officer has been promoted to Senior Documentation Officer and joined on 8 December 2013.
- Mrs. Afroza Anjum, Graphic Designer has been promoted to Senior Reprographic Officer and joined on 8 December 2013.

The following staff have been promoted during the period:

- Mr. Md. Abdul Hamid, Assistant has been promoted to Head Assistant and joined on 7 August 2013.
- Mr. Md. Abdul Alim, Assistant has been promoted to Head Assistant and joined on 7 August 2013.
- Mr. Jitesh Chandra Roy, UDA has been promoted to Office Assistant-cum-Computer Operator and joined on 7 August 2013.
- Mr. Sontosh Kumar Roy, Stenographer-cum-Computer Operator has been promoted to Head Assistant and joined on 7 August 2013.
- Mr. Zubaer Reza, Auditor has been promoted to Account Assistant and joined on 7 August 2013.

Besides, 3 staff have been given time scale and 1 staff has been given selection grade.

which is submitted before the Public Accounts Committee (PAC) of the National Assembly.

FINANCE

Introduction

Bangladesh Agricultural Research Council is the apex body of the National Agricultural Research System (NARS) now comprising 13 national agricultural research institutions. As per the recently approved BARC Act 2012, it has the mandate to develop priorities in agricultural research, allocate resources and function as a coordinating body to improve the overall research activities of the NARS. BARC receipts funds from Development and Revenue Budgets of the Govt. to conduct its annual mandate activities like Research management, Coordination, Monitoring, Evaluation, Technology transfer and manpower development and improvement of the production of Rice, Pulse, etc. In this respect BARC's Finance Division prepares the MTBF budget and financial plan of medium term activities and accordingly disburses fund for achievement of the goal. It keeps all the record of expenditure incurred during the year and reports to the Ministries, CAO, IMED, Development Partner and other Govt. Offices properly. It also reconciles the Accounts with CAO to prepare the final Accounts

Budgeting and Expenditure Control

The Govt. implemented "Medium Term Budgetary Framework (MTBF)" for all the Ministries including Ministry of Agriculture and its Division, Bodies and Corporations since 2005-06. Accordingly, BARC prepared budget in the form of MTBF for Revenue Head and Development Projects and submitted to the Ministry for approval. In this respect BARC has a Budget Committee headed by the Executive Chairman, BARC.

Fund Release/Disbursement

BARC makes proposal for the release of fund from the Govt. on quarterly basis as per approved annual allocation of Budget. In the Financial year 2013-2014 BARC received Tk. 1313.02 lakh for Salary and allowances, Core Research, Technology Transfer and manpower development and operational fund. To implement these activities funds were released to the Agricultural Research Institutes (ARI's) and associated organizations according to the budget plan. The overall financial progress made during the 2013-14 Tk.1233.90.

a) Financial progress under Revenue Budget:

(Taka in lakh)

Sl. No.	Line item	FY 2013-14		Achievement%
		Budget	Expenditure	
1.	Pay of Officer	200.00	180.00	90%
2.	Pay of Staff	180.00	160.00	89%
3.	Allowances	445.02	407.00	91%
4.	Research Grant	140.00	135.50	97%
5.	Manpower Development/Training	62.00	61.50	99%
6.	Utility	101.00	101.00	100%
7.	Other operational	72.50	71.40	98%
8.	Repair and Maintenance	33.00	32.50	98%
9.	Leave Salary & Gratuity	80.00	79.00	99%
10.	Capital Expenditure	6.00	6.00	100%
	Total :-	1319.52	1233.90	94%
11.	(-) Self Income	6.50	6.50	
		1313.02	1227.40	

b. Core-Research :

BARC Implemented 36 no's of Core Research activity during the year under it's Schedule Research Institute

(SRI) and Associated organizations as per mandate of BARC. The financial progress of the Core Research are as follows:

SI #	Name of Institute	No. of Core Research	Financial Progress
1.	Sylhet Agricultural University	-	876,400
2.	Sher-e-Bangla Agricultural University	-	750,000
3.	BAURES, Bangladesh Agricultural University	-	4,806,328
4.	Soil Recourse Development Institute (SRDI)	-	760,000
5.	Bangladesh Agricultural Research Institute (BARI)	-	3,289,332
6.	Bangladesh Institute of Nuclear Agriculture (BINA)	-	800,000
7.	Bangabandhu Sheikh Mujibur Rahman Agril.Univ.	-	300,000
8.	Bangladesh Jute Research Institute (BJRI)	-	300,000
9.	Patutakhali Science & Technology University	-	300,000
10.	Hazi Danesh Science & Technology University, Dhaka	-	300,000
	Total=		12,482,060

Development

(a) Sub-SPGR

National Agricultural Technology Project (NATP) is a world Bank/IFAD funded project implemented by Project Co-ordination Unit (PCU), Sponsored Public Good Research (SPGR) of Agricultural Research support component under NATP is being implemented by BARC through Project implementation Unit (PIU). BARC Head Quarter undertook 14 sub- Project under Sponsored Public Good Research (SPGR) for the

financial year 2013-2014 for Coordinated Research, adopting research, extension activities, enhancing research capacity, farm productivity, assigning cropping pattern, fertilizer management, pest management, arsenic management, development of Management efficiency including policy Planning. During the Financial Year 2013-2014 BARC implemented 16 sub-SPGR project. Comprehensive Expenditures are summarized below:

(Taka in lakh)

Sl #	Sub-SPGR	Salary & Remu.	Res. Expenses	Opt. Exp.	Fuel Oil Main	Trn/Work Shop/Seminar	Publication/Printing	Contingencies	Capital Exp.	Total
1	Soil Fertility...cropping pattern (SFFMP)	5.53	0	0.5407	0	0	0.448	0.34	0	6.86
2	Updating of Fertilizer.. Generated by The NARS	0.28	0	0.25	0	4.50	22.56	1.09	0	28.68
3	Coordinated Project on Arsenic...plant System	0	0	0.29	0	0	0	0.25	0	0.54
4	Contaminants & adulterants ... migration	7.55	0.48	1.08	1.87	4.74	0.29	1.47	0	17.48
5	Carbon Sequestration in Soils of Bangladesh	0	0.52	0.21	0.00	0.0026	0	0	0	0.73
6	Assessment of Land water in coastal area	0.18	0	0.12	0	0	0	0	0	0.30
7	Water Management for Changing climate	9.81	0	1.35	0.68	0.00	0	0.04	0	11.88
8	Improvement of Live hood & Environ.	6.402	0	2.052	2.469	1.245	3.099	2.11	0	17.38
9	Development and up scaling..Vegetable Crops	15.56	0	2.03	0.17	0.11	0	0.06	0	17.99
10	Coordinated sub project on ... Genetic Resources	8.01	0	1.36	0.04	1.69	0	0.55	0	11.65

11	Coordinated sub project on livelihood Imp.	16.52	0	1.19	0.77	0.28	0	0.57	0	19.33
12	Coordinated sub project on .. Ecosystems Bd.	30.50	11.60	2.46	2.81	5.65	2.50	1.21	0	56.75
13	Surveillance of important . of BD	3.59	0	0.43	0.26	0.90	0	0.72	0.77	6.67
14	Application of GIS Cropping pattern of BD	1.33	34.70	8.10	0.99	1.13	0.23	0.40	0	46.88
15	PPR Vaccine	3.60	0	0.44	0.27	0.83	0	0.07	2.78	7.99
16	Development of an ...of the NARS Institute	8.78	8.52	0.60	0.99	1.49	0.18	1.17	7.28	26.01
	Grand Total							277.12		

(b) Asian Food and Agricultural Cooperation Initiative (AFACI), Korea, funded 4 no project to Bangladesh Agricultural Research Council (BARC) to increase Production of Crops for attaining self-sufficiency in food.

AFACI Project Expenditure

(Tk. In Lakh)

Sl #	Project Name	Local travel	Progrm. planing	Supp-orting Staff	Works hop	Tech. allowance	Publica -tion	Statio-naries	Foreign visit	Total
1.	Collection,characteri-zation and chilli in Bangladesh	0.00	0.19	0.00	0.00	0.00	0.00	0.48	13.97	14.64

Sl #	Project Name	AFACI Off. Visit	Unseen Expendi-ture	Works hop	Coor dinati on Meet ing	Trainin g & Publica tion	Computer/ Multimed i a/Camera	Air Condi-tioner	Station aries	Total
2.	Development of Variety,.. AFACI	0.30	0.30	1.39	0.34	2.46	0.24	1.0	1.02	7.05

Sl #	Project Name	Meeting (Overseas)	Local travel	Printing publication	Manual devel.	Stationaries	Workshop	Miscell aneous	Total
3.	Establishment of networkin Bangladesh	1.70	0.18	0.00	1.67	0.18	0.91	0.02	4.66
4.	Development of Locally.. GAP Safety Information System.	2.98	0.33	0.00	1.75	0.13	1.07	0.02	6.28

Accounting

Maintain accounts following standard accounting system keeping a well-printed Cash Book, Ledger, Advance Register, Budget Control Register and other related books to record all transaction during the year accurately.

GOB Audit

GoB local audit department conducted audit of 2013-2014 and raised 10 nos of audit objection Broadsheet reply sent to local audit department to resolve the said audit objection.

Settlement of audit objection

During the year 2013-14 a remarkable number of audit objection has been settled are appended below:

Sl. #	Particular	No.	Settled audit objection
1.	Revenue	11	3,71,00,000.00
2.	Development	1	5,00,000.00
	Total	12	3,76,00,000.00

Reporting

BARC Finance section keeps all the record of expenditure incurred during the year and reports to the Ministry, IMED, CAO, Development Partner and other Government offices Monthly, Quarterly, Half yearly and annually for revenue budget, development and programme.

Monitoring and Evaluation

Monitoring and Evaluation an integral part of an effective planning and performance based budgeting plan becomes successful and the value for money is realized only when the proposed targets for outcomes/outputs are achieved. To attain the targets BARC Finance section regularly desk monitoring the status of utilization of fund before releasing fund for plan activities including budgetary and expenditure control mechanism.

Reconciliation

It also reconciles the Accounts with CAO to prepare the Final Accounts which is submitted before the Public Accounts Committee (PAC) of the National Assembly.

Retirement benefits

During the year 2013-14 retirement benefits and CPF Payment made to the Officer's and Staff of BARC are shown below:

A) CPF Final payment:

1.	Officer's	2 No.	Tk. 1,47,447/-
2.	Staff	3 No	Tk. Nil
		Total Tk.=	1,47,447.00

B) Gratuity payment:

1.	Officer's	No.	Tk. Nil
2.	Staff	4 No.	Tk. 59,85,000/00
		Total Tk.=	59,85,000/-

C) Leave Salary payment: Leave Encashment allowed to the Officer's and Staff during the year are as follows:

1.	Officer's	4 No	Tk. 12,41,000/-
2.	Staff	6 No	Tk. 7,59,000/-
		Total Tk.=	20,00,000/-

D) CPF Loan: CPF loan given to the Officer's and Staff during the year and Taka 1,27,46,100/- has been recovered against the previous sanctioned loan.

1.	Officer's	10 No	Tk. 61,77,000/-
2.	Staff	38 No	Tk. 65,69,100/-
		Total Tk.=	1,27,46,100/-

Group Insurance

BARC undertook Group Insurance for well being of its Officers and Staff for any unavoidable incident with Jiban Bima Corporation since 36 years.

We mourn at the lost of our three colleagues i) Yusuf Ali, Driver (ii) Mahtab Hossain, Driver (iii) Md. Haider Ali, Driver during the year. We received an amount of Tk. 8,21,160/00 as compensation under Group Insurance from Jiban Bima Corporation for the aforesaid deceased and payment made to their nominees accordingly.

Professional Staff

Office of the Executive Chairman

Md. Kamal Uddin, PhD, Executive Chairman
Md. Hussyam Uddin Parvez, PS to Executive Chairman

Crops Division

Md. Khalequzzaman Akanda Chowdhury, PhD, Member Director
Abul Kalam Azad, PhD, Chief Scientific Officer
Md. Aziz Zilani Chowdhury, PhD, Chief Scientific Officer
Mian Sayeed Hassan, PhD, Principal Scientific Officer
S.M. Khorshed Alam, PhD, Principal Scientific Officer
AKM Mahbulul Alam, PhD, Principal Scientific Officer (on Lien)

Planning and Evaluation Division

Paresh Chandra Golder, PhD, Member Director
Md. Shamsher Ali, PhD, Chief Scientific Officer
Md. Abdul Awal, PhD, Principal Scientific Officer
Md. Abdus Salam, PhD, Principal Scientific Officer

Natural Resources Management Division

Sultan Ahmmed, PhD, Member Director (Current Charge) & Chief Scientific Officer
Mohammad Shahjahan, PhD, Chief Scientific Officer (Forestry)
Md. Abdus Satter, PhD, Chief Scientific Officer (Soils)
Shaikh Mohammad Bokhtiar, PhD, Principal Scientific Officer (Soils)
Md. Baktear Hossain, PhD, Principal Scientific Officer (Soils)
Dr. Nazmun Nahar Karim, PhD, Principal Scientific Officer (Ag. Engg.)

Fisheries Division

Md. Kabir Ikramul Haque, PhD, Member Director (Current Charge) & Chief Scientific Officer

Nutrition Unit

Md. Monirul Islam, PhD, Director

Livestock Division

Shah Md. Ziqrul Haq Chowdhury, PhD, Member Director (Routine Charge) & Chief Scientific Officer

Agricultural Economics and Rural Sociology Division

SM Khalilur Rahman, PhD, Member Director (CC)

A.S.M. Anwarul Huq, PhD, Chief Scientific Officer
Mosharraf Uddin Molla, PhD, Principal Scientific Officer (on Lien)

Technology Transfer Monitoring Unit

Mian Sayeed Hassan, PhD, Director (Current Charge)
Fauzia Yasmin, PhD, Principal Scientific Officer (CC)

Agricultural Information Centre

Dil Afroz, Director
Md. Rafique Mostafa Kamal, Principal Doc. Officer
Shah Md Monir Hossain, Senior Scientific Editor
Afroza Anjum, Senior Reprographic Officer
Susmita Das, Senior Documentation Officer
Md. Alamgir, Graphic Designer (Current Charge)

Computer and GIS Unit

Md. Abeed Hossain Chowdhury, Director
Hasan Md. Hamidur Rahman, Senior System Analyst
Md. Shohid Uddin Bhuiyan, System Analyst
Md. Abdul Mabin, Programmer
Mihir Kanti Sarker, Data Entry Officer
Md. Ayub Hossain, Data Entry Officer

Manpower and Training Unit

M. Aminuzzaman, Director (Current Charge)
Md. Mustafizur Rahman, Pr. Training Off.(Addl. Charge)

Administration and Finance Division

Abul Kalam Azad, PhD, Member Director (Rout. Chrg.)

Support Service Unit

Shaikh Mohammad Bokhtiar, PhD, Director (Addl. Charge)
Md. Abdul Mottakin, Deputy Director (Establishment)
Md. Daloar Hossain, Senior Assistant Director (Estb.)
KM Ali Haider, Assistant Director (Establishment)
Md. Nasir Uddin, Assistant Director (Store)
M Nazim Uddin, Senior Assistant Director (Proc), CC
Md. Ershad Ali, Executive Engineer, CC
Dalil Uddin Boshnia, Assistant Director (Common Service) (Addl. Charge)

Finance Unit

Md. Mozibar Rahman, Director
Ajit Kumar Chakraborty, Deputy Director (Accounts)
Md. Jashim Uddin Chowdhury, Deputy Director (Budget)
Md. Mahbulul Hassan, Sr. Assistant Director (Budget)
Md. Lokman Hossain, Assistant Director (Audit), CC

THE GOVERNING BODY

BANGLADESH AGRICULTURAL RESEARCH COUNCIL

1	Honorable Minister for Agriculture	Chairman
2	Honorable Minister for Fisheries and Livestock	Co-Chairman
3	Honorable Minister for Environment and Forests	Co-Chairman
4	Mr. Nazmul Hasan, Parliament Member, Kishoregonj-6	Member
5	Mr. Abdul Mannan, Parliament Member, Parliament Member, Bogra-1	Member
6	Secretary, Ministry of Agriculture	Member
7	Secretary, Ministry of Fisheries and Livestock	Member
8	Secretary, Ministry of Environment and Forests	Member
9	Member (Agriculture), Planning Commission	Member
10	Vice Chancellor, Bangladesh Agricultural University	Member
11	Chairman, Bangladesh Agricultural Development Corporation	Member
12	Executive Chairman, Bangladesh Agricultural Research Council	Member
13	Director General, Department of Agricultural Extension	Member
14	Director General, Bangladesh Agricultural Research Institute	Member
15	Director General, Bangladesh Rice Research Institute	Member
16	Director General, Bangladesh Jute Research Institute	Member
17	Director General, Bangladesh Institute of Nuclear Agriculture	Member
18	Director General, Bangladesh Sugarcane Research Institute	Member
19	Director General, Department of Livestock Services	Member
20	Director General, Department of Fisheries	Member
21	Joint Secretary, Finance Division, Ministry of Finance	Member
22	Joint Secretary (Discipline and Law), Ministry of Public Administration	Member
23	Chief Conservator of Forests, Bangladesh Forest Department	Member
24	Dr. M.A. Hamid Miah, Liaison Scientist, IRRI Bangladesh, House#9, Road#2/2, Banani, Dhaka	Member
25	Dr. Qazi Kholiquzzaman Ahmad, Chairman, Palli Karma-Sahayak Foundation, PKSf Bhaban, Plot-E, 4/B, Agargaon, Dhaka	Member
26	Professor Dr. M. Nurul Islam, BUET, Flat-7, Minakkhi Apartment, House#27, Road# 12A (New), Dhanmandi, Dhaka	Member
27	Mr. Motahar Hossain Mollah, President, Bangladesh Krishok League, Kapasia, Gazipur	Member
28	Mr. A.K.M. Azad, Proprietor, A.M. Traders, Globe Center, 28/1 Indira Road, Farmgate, Dhaka	Member
29	Dr. Mahabub Hossain, Adviser to Executive Director, Bangladesh Rural Advancement Committee, BRAC Center, 75, Mohakhali, Dhaka	Member
30	Member Director, (Administration & Finance), BARC	Member Secretary

THE EXECUTIVE COUNCIL

BANGLADESH AGRICULTURAL RESEARCH COUNCIL

1.	Executive Chairman, Bangladesh Agricultural Research Council, Dhaka	Chairman
2.	Director General, Bangladesh Agricultural Research Institute, Gazipur	Member
3.	Director General, Bangladesh Rice Research Institute, Gazipur	Member
4.	Director General, Bangladesh Jute Research Institute, Dhaka	Member
5.	Director General, Bangladesh Institute of Nuclear Agriculture, Mymensing	Member
6.	Director General, Bangladesh Sugarcane Research Institute, Ishurdi, Pabna	Member
7.	Director General, Bangladesh Livestock Research Institute, Savar, Dhaka	Member
8.	Director General, Bangladesh Fisheries Research Institute, Mymensingh	Member
9.	Director, Bangladesh Tea Research Institute, Srimongal, Moulvibazar	Member
10.	Director, Bangladesh Forest Research Institute, Chittagong	Member
11.	Director, Soil Resource Development Institute, Dhaka	Member
12.	Director, Bangladesh Sericulture Research and Training Institute, Rajshahi	Member
13.	Executive Director, Cotton Development Board, Dhaka	Member
14.	Executive Director, Krishi Gobeshona Foundation, Dhaka	Member
15.	Member Director (Crops), BARC	Member
16.	Member Director (Planning and Evaluation), BARC	Member
17.	Member Director (Natural Resources Management), BARC	Member
18.	Member Director (Agricultural Economics and Rural Sociology), BARC	Member
19.	Member Director (Livestock), BARC	Member
20.	Member Director (Fisheries), BARC	Member
21.	Member Director (Administration and Finance), BARC	Member

